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Abstracts. Initialled abstracts in the present number are by J. L. Edgar, A. M. Massee, W. S. Rogers and M. C. Vyvyan.

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Horticultural Abstracts

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HORTICULTURE—MISCELLANEOUS.

161. DIRECTORS OF AGRICULTURE, PUNJAB AND CENTRAL PROVINCES, AND
PROFESSOR OF AGRICULTURE, POONA. 631.37 : 633.912
Report on the working of pneumatic rubber tyre equipment for farm carts.
Agric. Live-Stk. India, 1935, 5 : 43-6.

Three reports from different parts of India are made comparing the Dunlop rubber tyre equipment for country bullock carts with the ordinary bullock cart. In each case the reports were favourable to the rubber tyre equipment. It enabled double the load to be drawn, i.e. 2 tons instead of 1 ton, and was easier to load and unload owing to its lower clearance of 17 inches against 24 inches.

162. THOMPSON, W. A. 631.436
Soil temperatures at Winnipeg, Manitoba.
Sci. Agric., 1934, 15 : 209-17, bibl. 7.

Electrical resistance thermometers were installed at Winnipeg, Manitoba, in a clay soil with grass upon it at the following depths:—Surface, 4", 10", 20", 40", 66", 9 ft., 15 ft. Averages of weekly readings covering the 3 years 1931-33 are given in clear diagrams. Little variation was found between the curves for individual years. In summer, as the depth increases, the temperature decreases and the reverse holds good in the winter. The surface soil temperature varied from 70°F in July to 18°F in December. Variations decreased and lag in change of temperature increased as the depth of soil increased. The lag was about 3 hours at 4", and 6 months at 15 ft. At 40" the maximum was 56°, reached in August, and the minimum 30° in March, while at 15 ft. the maximum was 42.5 in January and the minimum 39° in July. It is suggested that at 20 ft. the temperature would remain constant. The depth of frost penetration varied; it usually reached between 5 and 7 ft. in March or April. The ground at 4" was usually frozen from November to April. The effect of snow covering in keeping up the soil temperature is noted. When the air temperature went below -30° the surface soil thermometer, covered with snow, showed +20°. It is suggested that measures such as soil drainage, which hasten rise of temperature in spring, should help early growth.

W.S.R.

TREE FRUITS, DECIDUOUS.*

General.

163. KEMMER, E., AND REINHOLD, J. 631.16 : 634.1/7
Die Wertabschätzung der Obstbäume. (Fruit growing, costings and valuations.)
Grundlagen u. Fortschritte im Garten- u. Weinbau, Heft 7, 1935, pp. 104.

This is a very exact treatise on the economic aspects of fruitgrowing in which the intending or actual fruitgrower is instructed precisely how to estimate the present value of his trees or bushes, what he should spend on them yearly and their future value at any time in their estimated life time. The figures are based on actual data obtained at Berlin Dahlem and elsewhere working

* See also 324.

with a large number of named varieties of different fruit species on different soils under different environmental conditions and on different rootstocks. Results are most attractively graphed to show the differences due to particular factors. The whole book should prove a source of joy and inspiration to the precise fruitgrower, provided he will use the tables and data as indications of reasonable methods of reckoning and not consider them as gospel, irrefutable stable facts.

164. EVREINOFF, V. A. 587.34
 Azeroliers à gros fruits (*Crataegus Azarolus*). (Large fruited azaroles.)
Bull. Soc. nat. Hort. Fr., 1935, 2 (ser. 6) : 166-7.

A number of large fruited forms of *Crataegus Azarolus* L. are described. These forms were discovered a few years ago in the Kopet-Dagh mountains of the Transcaspien district of Asiatic Russia by Bogouchewski, the Russian pomologist. The fruits are much larger than those of the ordinary forms, they are sweet and have a delicate strawberry flavour. The trees which grow to about 20 ft., are resistant to extremes of heat and cold and will support hot dry climates and impoverished soils in which no other fruit, not even the almond, will survive. Their introduction into districts where these conditions obtain should be of considerable economic value.

165. KINMAN, C. F., AND MAGNESS, J. R. 634.13-1.541.11
Pear growing in the Pacific Coast States.
Fmrs.' Bull. U.S. Dep. Agric. 1739, 1935, pp. 40.

The best approved methods of pear growing in these States are set out. The characteristics of the more important pear districts are noted and a general picture of the pear industry on the production side is given. The chief varieties grown are Anjou, Bartlett (Williams), Bosc, Clairgeau, Hardy, Comice, Easter Beurre, Forelle, Glou Morceau, Wilder Early and Winter Nelis. Among rootstocks, all seedlings, *Pyrus communis* is the commonest and, despite its susceptibility to the pear blight bacterium, appears still to be the best stock available for general planting. *Pyrus serotina* was popular at one time owing to its greater resistance to blight and to woolly aphid and to its vigorous growth on open soils. On heavy, wet or shallow soils, however, it produces unsatisfactory trees and in California it is thought to be responsible for "black end". *P. calleryana* and *P. ussuriensis* have been tried in many orchards. The use of the latter has not been approved as it has not proved immune to blight, while black end disease has been noticeable in trees of which it forms the roots. *P. calleryana* gives more promise except for the fact that it is apparently more subject to winter injury than *P. communis*. The quince is used where the soil is shallow or where close planting or early fruiting is desired. This practice is most prevalent in the San Francisco Bay district. One variety of *P. communis* known as "Old Home" seems to offer promise. It is itself very resistant to blight and it is hoped that it "will also produce blight resistant seedlings and therefore furnish a satisfactory stock". [No mention is made of the possibility of reproducing its blight resistant qualities by vegetative propagation. It may be noted, moreover, that Reimer in 1925, *Sta. Bull. Ore. agric. Coll.*, 214, suggested that trunk and root blight could be largely prevented in new orchards by using Old Home as an intermediate stock on a resistant rootstock.—ED.]

Propagation.*

166. GARNER, R. J. 631.541.5 : 634.1/2
Studies in nursery technique. Shield-budding—the removal of the wood.
 (A progress report.)
Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 123-6, bibl. 6.

Shield budding is one of the most common form of buddings used in England, but both here and on the mainland of Europe it is now generally considered advisable to remove the wood from the bud shield prior to insertion. This operation involves time and skill and may involve injury to the bud, and it is commonly dispensed with in the U.S.A. [As indeed it was frequently in the old world before the sailing of the *Mayflower*.—ED.] When at East Malling during

* See also 241, 242.

1919-31 it was found necessary to insert buds of apple, pear and plum with the wood attached owing to the condition of the scion variety, such buds invariably gave rise to the normal proportion of good maiden trees. In 1932 comparative trials were started with Lane's Prince Albert, and in 1933 further trials with Cox and Worcester on various stocks were laid down. Similar trials with pears, plums and cherries were also carried out in the same season. Details on the subsequent growth of the 3,252 buddings concerned indicate that there is no marked difference between trees raised by the one and by the other method.

167. WYMAN, D., AND NIXON, M. W. 631.53 : 631.588.1

Electric hotbeds for propagating woody cuttings.

Bull. Cornell agric. Exp. Sta. **618**, 1934, pp. 21.

In electrically heated hotbeds insulated resistance wires are laid in the ground and current is passed through them. It is not claimed that rooting is better in such beds, but three years' trials starting in 1932 together with the good results obtained by two nurserymen have convinced the authors that (under New York conditions) the cost of construction and operation of a large series of electrically heated beds over a period of years is considerably less than that of a similar series of manure heated beds. Notes and diagrams are given describing the construction and use of electrically heated beds.

168. TUKEY, H. B., AND BRASE, K. D. 631.541.11 : 634.11/13 and
631.535.7 : 634.711

Random notes on fruit tree rootstocks and plant propagation.

Bull. N.Y. St. agric. Exp. Sta., **649**, 1934, pp. 22, bibl. 9.

This bulletin contains some interesting observations made during the course of investigations on major problems. *Apple rootstock compatibility.* Notes are given on the different compatibility shown by particular apple varieties to one particular clonal apple rootstock known as U.S.D.A. 227. The evidence given here tends to indicate that chromosome content does not affect compatibility. *Leaf bud cuttings.* Black and purple raspberries rooted well from these, but red raspberries failed to root. *Pear rootstocks.* Trials with seedling rootstocks of *Pyrus communis* including Winter Nelis and Bartlett proved them successful as regards vigour and uniformity of growth for Bartlett, Seckel, Anjou and Kieffer varieties at the end of 4 years. *Pyrus calleryana*, *P. ussuriensis* and *P. serotina* were found to be unsatisfactory for these 4 varieties except as regards Kieffer on its near relatives *P. ussuriensis* and *P. serotina*. *P. betulaefolia* produced Bartlett, Seckel and Kieffer trees of outstanding size, vigour and early fruiting, but was unsuitable for Anjou. Other observations concern winter killing of mounded quinces, seedbed coverage, dormant budded roses.

*Rootstocks.**

169. WOODHEAD, C. E. 634.1/2-1.534/535

Fruit-tree rootstocks. Methods of vegetative propagation.

N.Z. J. Agric., 1935, **50** : 92-5.

The stooling and layering etiolation methods are described. The former has been successfully applied to imported East Malling apple rootstocks types I, IX, XII, XIII, XV, XVI. The local Northern Spy, however, does not respond easily to the ordinary stooling method in which the earthing up of the stools in the spring is not done until the new shoots are 4 inches high, but has to have its stools covered with an inch of soil in early spring just as the buds are swelling in order to ensure satisfactory root production. With this method the base of the new shoot receives no preliminary exposure to the light. Wild pear, mazzard cherry types, and the plums brompton, common mussel, pershire, myrobolan B and black damas C are also more easily rooted by etiolation. The last two plums, however, are propagated more easily and with less labour by means of hardwood cuttings. The commercial apples, Cox's Orange, Delicious, Gravenstein, Jonathan and Sturmer root easily when thus layered.

* See also 174, 179, 233.

170. HATTON, R. G. 634.11-1.541.11
East Malling's experiences with apple rootstocks.
Fruit-Grower, 1934, 78 : 857-60 and *Annu. Rep. East Malling Res. Sta. for 1934*,
 A18, 1935, pp. 223-8.

The author summarizes the practical position at the end of 21 years' work on apple rootstocks. Answers are already given to many questions which were a matter of burning interest 21 years ago. Much still remains to be done. The progress made and the work in hand are outlined here. *Soil and management.* Different soils do tend to lessen or accentuate rootstock influence, but rarely if ever alter the relative effect. Different rootstocks do not necessarily respond in a similar manner to the same management, i.e. manuring, cultural treatment, etc., and this must be modified accordingly. *Planting distance and life of trees.* Planting on "Paradise" does not mean planting at 8 to 10 feet square, a distance which will, however, on not too rich a soil probably suit No. IX, nor do trees on IX cease to yield and die after 10 to 15 years, as was commonly prophesied some years ago. Planting must be done according to the growth capacity of the worked stock and to the type of soil. Among the tested "Paradise" are all sizes with a possible exception of an ideal semi-dwarf, and the latter is now being sought by breeding and testing. *Cropping and early bearing.* Early cropping is not assured just by planting on "Paradise", but here again the wide range available can supply the grower's need. Cropping of particular varieties on the different stocks has been consistently the same. Where bearing capacity has become stabilized as on mature No. IX stocks the quality of fruit has not deteriorated, any tendency noticed being in the opposite direction. *Fruit quality.* Fruits on IX ripen earlier than those on most other rootstocks and therefore need picking earlier to ensure successful storage. *Present position.* A recent survey* of established bush plantations on the Lower Greensand in Kent showed that the most common form of "Paradise" was a mixture of Nos. II, III, IV and V. If it is required to tune up an orchard of these "mixed" trees, the task is extremely difficult. It would be infinitely greater, were the trees in these orchards on crab stocks, i.e. on individuals of potentialities and reactions to any one management factor quite unknown. In the future growers planting now on known stocks may indeed be confronted with the same necessity for tuning up, but their task will be simple in comparison.

171. HATTON, R. G. 634.13-1.541.11 : 634.14
Rootstocks for pears.
Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 75-86, bibl. 4.

Work during the last 20 years at East Malling has shown that it is just as unwise to generalize about pears on quince and on free or seedling pear stocks as it is to generalize about apples on paradise and on crab stocks. During this period individual tree records have been taken for cropping and certain expressions of growth of Conference, Beurré Hardy, Doyenné du Comice, Durendeu, Pitmaston Duchess, Fertility and Dr. Jules Guyot budded on five quince varieties. In this bulletin the methods of classifying, identifying and standardizing (by vegetative propagation) quince stocks and free stocks are reviewed. The vigour and cropping of 10-year-old Dr. Jules Guyot trees on 5 selected free stocks are compared. Large differences are found in vigour as also in cropping. Only very small crops were recorded during the period [but the fruits harvested in the two seasons subsequent to the figures being taken confirm those already taken.—Author's footnote.—ED.]. Individual trees were found to crop very quickly on particular free seedling stocks. Hence it is suggested that it should be possible to select and standardize desirable free stocks. Results on the 5 quince stocks under trial, designated A, B, C, D, and E, are discussed. The general utility of A and B are compared. After 9 years trees on C fell behind in vigour owing to heavy cropping, the cropping, however, being maintained. Scion rooting on quince is of common occurrence and results in serious crop reduction. Trees where this has taken place may be detected by their exceptionally upright, vigorous growth and their large dark green foliage. This rank growth seems

* *Bull. Minist. Agric. Lond.*, 80, 1934 ; *H.A.* 1934, 4 : 4 : 692.

unfortunately often to lead to severe scab infection. There is some slight evidence that if a tree has been growing normally on a compatible quince rootstock and has begun to crop appreciably before scion rooting, results of scion rooting may be less detrimental than when a variety gets on to its own roots early in its career or after a period of extreme dwarfingness on an incompatible rootstock.

172. WARNE, L. G. G., AND WALLACE, T. 634.11-1.541.11 : 581.192
The composition of the terminal shoots and fruits of two varieties of apple in relation to rootstock effects.
J. Pomol., 1935, 13 : 1-31, bibl. 21.

The trees used were Worcester Pearmain and Lane's Prince Albert. These were worked on vegetatively propagated, known stocks. Detailed pomological records were taken from time of planting in 1920 to 1928, using the individual tree as the unit, and from them values for precocity were calculated, being defined as total weight of fruit produced per 100 metres of shoot growth to 1926. In 1931, when the shoot samples were taken for chemical analysis, shoot elongation measurements and growth rates of shoots were determined for certain periods. The chemical determinations were made on terminal shoots collected in July, 1931, and on fruits from crops of 3 seasons within the period 1927-31. The methods of ascertaining the chemical constituents are set out. The actual constituents determined were: (1) for shoots total N, dry matter, total ash, and Ca, Mg, K, and P in the ash, and (2) for fruits the above plus reducing sugars, sucrose, total sugars and titratable acidity. The data, chemical and pomological, were treated statistically and the correlations or absence of correlations between the different features are noted. Careful examination failed to reveal that the dwarfing effect of Jaune de Metz (=Malling IX) stock could be based on any chemical feature. It was found that Malling II and Malling V displayed many of the known characters of potash deficiency even under conditions of favourable potash supply. The only agreement established between stocks promoting great vigour was in the possession of a high $\frac{K}{N}$ ratio in the shoots. Results show that many outstanding rootstock effects cannot be explained on the basis of the chemical characters examined. [From author's summary.] Data are tabulated as follows: Table 1, data for shoots. The stocks are set out in descending order of size of content of their chemical constituents for leaves, bark and wood separately. Table 2, data for fruits. Stocks are again set out in descending order of magnitude in significant groups for the various constituents expressed on a per cent of fresh weight basis. [That such differences are found is at least suggestive.—Ed.] In Table 3 the stocks are grouped on the basis of high and low values for various chemical constituents or ratios of constituents in the case of the two varieties separately. In Table 4 stocks are grouped on a basis of high and low values for various chemical constituents in both varieties.

173. TYDEMAN, H. M. 634.11-1.523 : 631.541.11
A study of the variations in leaf shape and petiole length in seedlings of "Paradise" apples.
J. Pomol., 1935, 13 : 32-8, bibl. 10.

The search continues for an early and certain method of determining the probable value as rootstocks of seedling apples. The author has in a previous article (*Ibidem*, 1933, 11 : 214-36, *H.A.*, 1933, 3 : 4 : 447) dealt with observations on the morphology of the summer and winter shoots and of the root systems of some 1,000 seedlings resulting from inter-crossing Malling IX with the rest of the Malling series of apple rootstocks. Little evidence of segregation into distinct classes could be obtained. In the present article he presents data taken later of two characters of which comparative measurements were obtainable, viz. the comparative breadth of the leaf lamina and the length of the leaf petioles. The leaves were taken from shoots arising from the stools, leaves from the same part of the shoots being chosen in each case. Ten leaves were measured from each of 525 seedlings and for comparison 100

leaves taken at random from about 400 stools of each of the parent varieties were also measured. The results statistically examined are, in the author's view, suggestive rather than conclusive. They point to the action of polymeric factors and indicate that a number of such factors are carried by all the rootstocks used as parents in these experiments, this view being supported by the variation and lack of discontinuity in the families. The material was not ideal for the investigation, particularly in that Malling IX was a parent common to all the seedlings. Crosses between other varieties might have provided valuable additional information.

*Rootgrowth.**

174. BANE, W. A., AND OTHERS. 634.11-1.541.11 : 581.144.2

A comparison of the root systems of mature trees of Bramley's Seedling and Worcester Pearmain on various rootstocks.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 90-9, bibl. 6.

The trees, in most cases 24 of each variety on each rootstock, were planted in the winter of 1919-20 and were grubbed in the spring of 1933 and the winter of 1934-5. The method of lifting was to remove the top soil and to cut the main roots at 3 ft. from the trunk except in one plot where the circle of cutting was 2 ft. Such a method of lifting did not of course show the position of the small feeding roots and fibre except those close to the stem, but it did afford a good general impression of the root system. Detailed descriptions are given of the root systems so disclosed of some 11 standardized rootstocks when worked with Bramley and Worcester Pearmain, significant differences in coarse and fine roots being tabulated and shown diagrammatically. On the whole these root systems generally resembled those of the young unworked stocks. [Stocks 4, 6 and 7 years old at excavation.—ED.] Most of the exceptions noted applied to both varieties and were probably the result of the difference of age rather than of scion influence. No consistent correlation was apparent between type of root system and tree performance. Many of the differences in root systems are clearly shown in the photographic illustrations.

175. BEAKBANE, A. B., AND DE WET, A. F. 634.11-1.541.11 : 581.144.2

The root systems of some Bramley's Seedling apple trees.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 87-9, bibl. 2.

Three 15-year-old trees, one on rootstock Malling I, one on II and one on IX were excavated. They were all growing at East Malling in a medium loam of the lower Greensand formation overlying Kentish Ragstone with a layer of sandy uncemented rock material separating the two. The land was clean cultivated until 1930, when it was laid down to grass. In the case of the trees on I and II stocks a block of soil 4 metres square and 1 metre deep was excavated and in the case of that on IX a block of 3.6 metres square and 1 metre deep. The root systems so disclosed showed general characteristics similar to those of the same rootstocks worked with Lane's Prince Albert previously excavated from an adjoining plot.† The actual features noted are described and illustrated by photographs. Scion rooting was found on the tree on II rootstock.

176. FRISCHENSCHLAGER, B. 634.1/2 : 581.144.2

**Wurzeluntersuchungen bei Apfel, Birne, Zwetschke, Kirsche und Walnusz.
(Root investigations on apple, pear, damson, cherry and walnut.)**

Gartenbauwiss., 1935, 9 : 269-92, bibl. 33.

The author discusses the general characteristic features of the root systems of various seedling fruit trees. He suggests that the branching of the root system can be indicated in figures by the so-called "root quotient" which is reached by dividing the weight of the roots by the actual number of roots (each tip counting as a root). The compactness of root branching is

* See also 162, 223.

† See *J. Pomol.*, 1934, 12 : 110-44; *H.A.*, 1934, 4 : 3 : 329.

partly due to heredity and partly to the effect of soil and scion. The effect of these factors on nutrient requirements is discussed. [The general conclusions reached would appear rather to be based on particular instances.—ED.]

Pollination.

177. NEBEL, B. R. 634.11 : 581.162.3

Effect of pollen on fruit quality.

Better Fruit, 1935, 29 : 11 : 6.

The author states that it is certain that differences in quality of apples due to pollen influence do occur but that they are too slight to be of commercial interest and can only be established by careful observation on large numbers of apples. The following instances are quoted. McIntosh trees pollinated with Red Astrachan produced slightly heavier and more acid apples than when pollinated with Yellow Bellflower. Compared with crab apple pollen Red Astrachan pollen produced in McIntosh apples fruit which was higher in acid and sugar and lost less weight in storage and possessed juice containing fewer substances prone to darken.

178. CALLMAR, G., AND JOHANSSON, E. 634.11 : 581.162.3

Pollinering och fruktsättning hos äpplesorter. (**Pollination of apples.**)

[English summary.]

Contrib. Swedish Perm. Cttee. Orch. Res., 34, 1935, pp. 46, bibl. 41.

The authors after reviewing previous work in England, Germany, Denmark, U.S.A. and Sweden discuss results obtained in Sweden during the years 1924-33 at Alnarp and near Stockholm. A list is given of some 80 varieties grown in Sweden together with the names of other varieties which have under Swedish conditions proved suitable for their fertilization. Those noted as good pollenizers for Cox's Orange Pippin are Arreskov, Boiken, Cox's Pomona, Golden Noble, King of the Pippins, Melonäpple (Pomme de Prince) Stenkyrke.

179. BEAKBANE, A. B., AND OTHERS. 634.1/2 : 581.145

Periods of blossoming of some tree and soft fruit varieties at East Malling.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 100-14, bibl. 3.

The actual records taken were : (1) The opening of the first flower. (2) The time when about 50% of the flowers were open and 50% not yet open (full bloom). (3) The time when about 90% of the flowers had fallen. The average dates of blossoming over a varying number of years at East Malling are given diagrammatically for a large number of apple varieties on stocks V, II, and IX, for some 48 pears on known quince and pear stocks, for 8 plum varieties on common mussel, for 8 damsons, for 76 cherry varieties, mainly sweet, and for 15 strawberry varieties.

180. KOBEL, F., AND STEINEGGER, P. 581.162.3 : 634.11 + 634.13

Die Befruchtungsverhältnisse von Apfel- u. Birnensorten u. der Nachweis von Intersterilität bei denselben. (**Pollination in apple and pear varieties and the determination of intersterility among them.**)

Landw. Jb. Schweiz., 1934, pp. 741-68, bibl. 44.

The authors' pollination trials and observations on the growth of pollen tubes in the pistils show that in pears and apples intersterility exists as well as self-sterility which is so common in these fruits. Thus the pears Beurré Williams and Louise Bonne are shown to be intersterile, while among apples Rose de Bern and Pépin de Parker are found to be intersterile with Reinette d'Oberrieden and Reinette d'Oetwil respectively. The position is more complicated than is the case with sweet cherries and it is found that triploid apples and pears are much more difficult to pollinate than diploids. Thus in experiments in 1933 Blenheim Orange could not be pollinated by Sauergrauech nor Belle de Boskoop by Transparent de Croncels. Similar crosses are now being attempted under different conditions. While it is essential that the number of varieties planted should be reduced, it is equally essential to ensure that measures are taken to ensure adequate pollination, in which connexion the date of flowering must not be forgotten. A considerable list is given of pear and apple varieties with appropriate pollinators as determined by Swiss or foreign workers of repute.

181. MEIER, K. 634.1/7-2.95 : 581.162

Bienenzucht und Baumbespritzung. (**Bee-keeping and spraying.**)

Reprinted from *Schweiz. Bienenztg.*, 1935, Nos. 1 and 2, pp. 16.

Lime sulphuring and spraying with arsenates have obviously come to stay until better control methods are evolved. For pollination, however, abundant insect life is necessary, and of insects hive bees are at least one of the more important types. Observations and examination of bees in Swiss orchards have shown that sulphur dioxide has the effect of repelling them. Sprays containing arsenical preparations only are not usually touched by bees, Nospratis proving a slight exception to this rule. If, however, sugar is added, the bees readily absorb it and may die, if sufficient is absorbed. Sprays containing both lime sulphur and arsenicals are avoided by the bees even in the presence of 10% added sugar. It would appear, therefore, that there is no objection to the use of the above sprays provided no sugar is added.

*Growth and Nutrition.**

182. FINCH, A. H. 634.11 : 581.1

Physiology of apple varieties.

Plant Physiol., 1935, 10 : 49-72, bibl. 6.

The fruitful shoots borne by biennial bearing trees in their "off" year differed considerably, in time and type of terminal growth, in anatomical structure and in relative chemical composition, from the unfruitful growths borne in the "on" year. Terminal growths on regularly bearing trees and on shy bearing trees were intermediate in character. Terminal growth, accumulation of starch and formation of xylem started earliest and proceeded initially fastest in the fruitful growths; these also had the highest starch to nitrogen and total carbohydrate to nitrogen ratios and the highest parenchyma to fibre ratios. The time and rate at which terminal growth and its leaf formation start in spring seemed to be closely correlated with the fruitfulness of the resulting growth. The chemical composition and physiological condition of a tree is indicated by the anatomy and character of the terminal growths, suggesting that these may be used as indices to cultural needs.

M.C.V.

183. DAVIDSON, O. W., AND SHIVE, J. W. 634.25 : 581.192

Determination of the nitrogenous fractions in vegetative tissue of the peach.

Plant Physiol., 1935, 10 : 73-92, bibl. 28.

Owing to the presence of a nitrogenous glucoside or glucosides peach tissues cannot be macerated in the preparation of an extract of soluble nitrogen without loss of nitrogen resulting. In the study described here an attempt was made to modify the methods commonly used in determining the nitrogenous fractions in plants in general, so that they could be used in examining the peach. Descriptions are given of the methods adapted to peach analysis for determining the following nitrogen fractions:—Cyanogenetic N, ammonium N, total soluble N, amide N, humin N, nitrate N, basic N, amino N, total N.

184. MEHRLICH, F. P. 581.11

A mechanism for controlled continuous flow of nutrient solutions.

Plant Physiol., 1935, 10 : 169-77, bibl. 2.

Owing to the change brought about by the plants growing in it the constant renewal of the nutrients in a nutrient medium is necessary, if the plant condition is to be correlated with a known composition of medium. An apparatus is described and illustrated which is a modification of Shive's device (*Amer. J. Bot.*, 1923, 10 : 554-67), but has the advantage of holding 38 litres instead of 2 or 3 and of allowing of repeated renewal without upsetting the rate of flow. It is practically self starting, and strong enough to withstand field work. It may be used with solution, sand or soil cultures. Variation in the amount of solution delivered by a series of units does not exceed 50 cc. per litre. Such variation in the amount of any one compound delivered, considering the low concentrations of nutrient solutions, seems immaterial. The rate of flow can be altered and measured at will without disturbing the cultured plants.

* See also 172, 173.

185. BAILEY, R. M., AND BURGESS, I. M. 634.11-1.546
Apple tree shape in relation to yield and growth.
Bull. Me. agric. Exp. sta., 377,* 1934, p. 375.

Scaffold branches of alternate Golden Delicious trees in one row are tied down each summer to produce an open type of tree. The remaining trees in the row serve as controls. During two years out of three the tied trees have shown slightly increased yield, and have regularly shown increased sucker growth.

186. RAGLAND, C. H. 634.25 : 581.145.1/2 : 632.19
The development of the peach fruit, with special reference to split pit and gumming.

Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 1-21, bibl. 23.

The author describes split pit in peaches generally and gumming in the Phillips Cling variety in particular and gives an account of studies made in the hope of explaining these phenomena. The development of the fruit was followed from bud differentiation until maturity and is here traced with the aid of numerous illustrations. No irregularities were found in the development of the ovule of the Phillips Cling to account for the abortion which is a very frequent feature of peaches showing split pit. The structure of the pit is described and its influence on the incidence of splitting is discussed. The vascular system of the fruit is described in detail, and the possible connexion of its arrangement with splitting is also considered.

187. CHANDLER, W. H. 581.144.4 : 634.1/2 : 581.192
The dry matter residue of trees and their products in proportion to leaf area.

Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 39-56, bibl. 9.

This study was first started at Cornell in 1917 to test the view that fruiting depletes the food supply of the tree by more than the amount of dry matter in the fruit. In 1924 trees were planted in California, at Davis and Berkeley (pears), to continue the study there. The varieties of different fruits used were apples Wealthy and Oldenburg, figs Kadota and Brunswick, persimmons Hachiya—these failed to grow and were replaced by Phillips Cling peaches,—pears Elizabeth and Hardy, peaches Elberta, J. H. Hale, apricot Royal. Half the trees of each kind were allowed to fruit, half were defoliated. There was no thinning of fruit. Fruit was harvested a little green to reduce losses from wind and other causes. It was weighed and samples were taken for dry weight determination. When trees were taken up, wood of each age and roots above and roots below $\frac{3}{4}$ in. in diameter were weighed separately and samples of each taken for dry weight determination. Trees were unpruned except for the removal of broken branches, the dry weight of which was included in calculations. Leaves were counted on each tree yearly and samples were taken for measurement. Sets of leaves were taken for each variety, being carefully chosen to give an even gradation in size from the smallest counted to the largest. There were 24 to 46 leaves in a set according to the variation in size and outline among leaves of a variety. Each leaf of each set was printed on blue paper and each print measured with a planimeter and numbered. These prints were then used as a standard with which the leaves of the samples were compared and sorted according to size and outline. The total leaf area was thus estimated. The following notes are taken from the author's summary of results. Fruiting actually seems to require less instead of more food than is needed to form the same dry weight of wood. The reduction in dry weight increase due to fruiting seems never to be so great in proportion to leaf surface as the dry weight of the fruit borne. No conclusive evidence is produced to show why this is so. One possible cause is photosynthesis in the fruit. Possibly it may be due to accelerated photosynthesis caused by removal to the fruits of products, which in a defoliated tree accumulate and inhibit photosynthesis—though analysis of leaves failed to disclose any such accumulations. It may be due to wood cells having longer lives than fruit cells and therefore making greater use of food in respiration. Since leaf surface is reduced by heavy fruiting, the annual dry matter accretion of a tree may be reduced by a heavy crop by

* Being a summary report of progress, 1934.

more than the dry weight of the fruit. Despite which a normal commercial crop may not reduce growth nearly so much as would crowding in the orchard or moderately unfavourable soil and climatic conditions.

188. TUKEY, H. B. 634.23 : 581.14
Growth of the embryo, seed and pericarp of the sour cherry (*Prunus Cerasus*) in relation to season of fruit ripening.

Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 125-44, bibl. 12.

Detailed measurements were made in the years 1929 to 1932 and again in 1934 on Early Richmond, Montmorency and English Morello cherries, varieties which ripen approximately 41, 57 and 66 days after full bloom respectively. The growth in 1934 of the embryo, nucellus and integuments and of the fruit is traced and the results are tabulated, graphed and discussed. The author urges plant breeders whose aim is the production of early-ripening fruit characters to remember the possible problem of embryo abortion when dealing with sour cherries as well as with peaches, some plums and sweet cherries. The following notes are taken from the author's summary. Three stages are found in the growth of the fruit. They are (I) A period of rapid increase after fertilization, this being nearly identical in all three varieties regardless of the season of fruit ripening. (II) A period of delayed increase during mid season. This is correlated directly with the season of fruit ripening, which in this period is 3 to 5 days for Early Richmond, 10 to 12 days for Montmorency and 24 to 28 days for English Morello. (III) A second period of rapid pericarp development. This is similar in all three varieties and continues until the fruit is fully ripe. Nucellus and integument development follow the first period of rapid fruit increase and they have attained maximum size when the stage of retarded development begins. The embryo is arrested in development until 20 to 23 days after full bloom, when it suddenly begins to grow rapidly, reaching maximum size in 18 to 25 days. Regardless of the season of ripening there is a direct relationship between the cessation of the first period of rapid fruit development, the attainment of maximum size of nucellus and integuments and the start of rapid embryo development.

189. GREENE, L. 634.1/7-1.55
Some factors aside from pollination that affect fruit set.

Penn. St. hort. Assoc. News, 1935, 12 : 60-6.

Fruit set is here defined as fruit which remains on the tree during the June drop. The ability of a spur to hold its fruit after pollination depends upon a very delicate balance within the plant tissues concerned in which moisture, food reserves and other growth relationships are involved. A disturbance of this balance, so small as to be beyond measurement, may result in a heavy loss of crop. Limiting factors are—weather, thus cold rainy weather following bloom can do more damage than frosts during bloom. A dry spring, high temperatures or strong winds may temporarily check the moisture supply sufficiently to affect the fruit, which is always the first to suffer. Examples of the set being greatly reduced by nutritional deficiencies are given. These may be due to any of the following causes :—excessive competition among fruits, root trouble caused by bad drainage or soil poverty or failure to remove filler trees, the use of excess or too high pressure lime sulphur and the use of oil sprays too soon after lime sulphur. Examples are given from personal experience.

190. ALDRICH, W. W., AND WORK, R. A. 634.13-1.542.27 : 581.145
Effect of leaf-fruit ratio and available soil moisture in heavy clay soil upon amount of bloom of pear trees.

Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 57-74, bibl. 16.

In their investigations the authors studied (1) the period during which fruit bud differentiation can be influenced, (2) the effect of fruit thinning on fruit bud differentiation, and (3) the effect of soil moisture on fruit bud differentiation. They found that the period during which differentiation could be influenced by leaf area changes varied in different varieties, results of two years' observations showing that it ended about a fortnight earlier for Anjou and Bartlett than for

Bosc. Fruit thinning on ringed limbs of the above varieties to give 100 leaves per fruit and defoliation to leave 10 leaves per fruit increased and decreased respectively the amount of fruit bud formation as compared with normal limbs. Fruit thinning of Bartlett, Bosc and Comice within 44 to 60 days of the beginning of full bloom resulted in increased bloom the following year, but not when the thinning was done later. For Anjou trees, which suffer from lack of moisture when soil humidity falls below 50 to 80% of available capacity, decrease in soil moisture below 30 to 40% during the period of possible effect on fruit bud differentiation resulted in increased bloom the following spring.

*Manuring, Cultural practice.**

191. CARDINELL, H. A., AND GRAY, G. F. 634.1/2-1.841.6

Defoliation from the use of calcium cyanamid.

Quart. Bull. Mich. agr. Exp. Sta., 1935, 17 : 101-5.

In the spring of 1934 in some districts in Michigan fruit growers using calcium cyanamide fertilizer reported more or less serious defoliation of cherry, apple, peach and currant. The defoliation began at various times, in some cases about 10 days after petal fall, in others not before harvest. The leaves first yellowed and soon afterwards dropped and affected trees continued to shed them till late August, the range of defoliation varying from slight to very severe. The more severe cases were on the lighter, drier soils deficient in organic matter. Trees growing in moist spots in several severely defoliated blocks showed little or no leaf injury. The outstanding characteristic of the primary stage of leaf injury was the brown or dead tip on the older leaves. This characteristic was present even on trees too slightly affected to show yellowing of the leaves. In more severely injured trees of sour cherry the brown area, $\frac{1}{4}$ - $\frac{1}{2}$ inch wide round the leaf margin, extended from the tip towards the base for about $\frac{1}{2}$ - $\frac{3}{4}$ the length of the leaf. In sweet cherries the entire margin was often involved. The leaves then turned yellow, beginning at the tip usually with a characteristic V outline. As the season advanced an increasing number of trees showed defoliation and this increased in severity. The fact that the rainfall was below normal for the season is believed to have been one of the main factors responsible for the injury and the known lack of available potash and phosphoric acid in many Michigan orchards may be another, since injury from nitrogenous fertilizers has been shown to accompany potash deficiency, particularly following applications of liming material such as cyanamide which carries hydrated lime. It is recommended pending further investigations that if cyanamide is used it shall be applied in autumn or very early in spring.

192. EATON, F. M. 631.453 : 546.27

Boron in soils and irrigation waters and its effects on plants, with particular reference to the San Joaquin valley of California.

Tech. Bull. U.S. Dep. Agric., 448, 1935, pp. 131, bibl. 42.

Boron is now considered to be essential to the growth of many plants, some being benefited by amounts of boron which are definitely harmful to other plants. The problem of boron tolerance has become acute in certain parts of the San Joaquin valley owing to the concentration of boron in the soil solution by transpiration and evaporation due to the long continued use of irrigation water containing small quantities of boron. Work at the Rubidoux laboratory, Riverside, California, is concerned with a determination of the degree of tolerance of different plants under different conditions. Deficiency symptoms, which are here described, only appear when the available boron is considerably below the concentration needed for the best growth of the plant. It is noticeable that cotton, figs, grapes, beets and asparagus have shown increased growth when supplied with boron in concentrations above what might be termed traces. Most fruit trees, on the other hand, especially citrus, are markedly susceptible to excess boron. In sand cultures the growth of lemons, grapefruit and avocados is sharply reduced by being supplied with nutrient solutions containing 3 parts per million of boron, that of stone fruits and pears

* See also 322.

by 6 to 9 p.p.m., while at the other end of the scale date palms and asparagus will tolerate up to 100 p.p.m. The symptoms of excess boron in the common fruit trees are in process of being noted carefully. They are at the moment undetermined for apple and pear though known for the stone fruits. Injury due to excess boron from continued irrigation with boron-contaminated water appears sooner on light than on heavy soils. Practical methods for removing boron from irrigation water or for counteracting toxic effects in the soil remain to be found, though citrus plants are known to be slightly more tolerant of it in the presence of abundant nitrates. A table of crop tolerances for some 54 cultivated plants is given. Conditions peculiar to the San Joaquin valley are discussed at some length and suggestions of a practical nature made with regard to the crops suitable for use. It is noted that a high percentage of sodium as compared with calcium and magnesium in some of the irrigation waters causes the soil to become hard and relatively impervious to water. This tends to result in increased concentration of the soil solution owing to the absence of leaching. A large number of analyses of San Joaquin waters are presented and discussed.

193. ROACH, W. A. 634.11-1.8
Tree injection.* Invigoration by the injection of fertilizers. (A progress report.)

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 135-8, bibl. 4.

An account of a preliminary but larger scale experiment than was reported last year.* The trees used were 21-year-old Cox's Orange Pippin bushes planted 12 ft. apart. They were on different rootstocks and were very variable. In the autumn of 1934, moreover, owing to the existing lack of vigour the strong growth of weeds was disced in and a dressing of 4 cwt. K_2SO_4 per acre was applied with the result that the growth of the trees was greatly stimulated. These two factors, variability and induced vigour, might have been expected to mask any effect of injection. Such was not the case. The most uneven trees were eliminated prior to the experiment. The remainder were divided into groups of three, one of each group being injected in June with a "complete fertilizer" solution containing 0.25% potassium phosphate (K_2HPO_4)† plus 0.25% urea, at rates varying from $\frac{3}{16}$ to $\frac{1}{8}$ lb. per tree or 10 lb. to 50 lb. per acre, one being injected with water, and one remaining untreated. The amount of shoot growth, judged by weight and number of prunings, was nearly doubled. The increase was greater, the greater the amount of fertilizer injected. Attack by the apple leaf hopper and red spider was less severe on the fertilizer injected trees than elsewhere. The quality of the fruit was not affected.

194. ROACH, W. A. 634.25-2.191-1.8
Tree injection. The diagnosis and cure of chlorosis in a peach tree. (A progress report.)

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 139-41, bibl. 5.

The author describes first how he diagnosed the cause of the chlorosis by small scale twig tip injections, how he then injected solutions of iron salts through holes in small branches and thereby determined a safe and effective concentration, and finally how he cured the chlorotic condition in a peach tree 10 ft. \times 10 ft. by injections into the two main branches.

195. WALLACE, T. 634.1/2-2.191
Investigations on chlorosis of fruit trees. V. The control of lime-induced chlorosis by injection of iron salts.
J. Pomol., 1935, 13: 54-67, bibl. 3.

Experiments were carried out at four centres on apples, pears and plums all showing signs of fairly severe chlorosis. The methods were similar to those described by Bennett (*Circ. Calif. agric. Exp. Sta., 321, 1931*). Ferric citrate in finely ground form was used. Holes were bored in trunks and branches by means of a brace and bit, the bits being $\frac{1}{2}$ in. and $\frac{3}{4}$ in. respectively. Where more than one hole was bored, the holes were made at different levels to avoid possibility

* See H.A., 1934, 4:2:191, 192.

† This was used as being a very safe solution, having little or no toxic effect.

of ringing in case of the wood becoming damaged. The holes always pointed slightly downwards. The powder was poured on to a piece of smooth paper and this was tilted into a glass adaptor tube with slightly narrowed end which was fitted into the hole so as to touch the bottom. The powder was gently tapped down the tube and after being all collected into the hole was finally pressed down with a glass rod and covered in with a small cork. The treatments were carried out so late in the dormant season that in some cases a few of the buds had already burst. In view of this the doses given were generally only about half to three-quarters of those recommended by Bennett. The operations were found to be very simple and capable of being carried out easily by unskilled labour. No controls were used but the results of treatments on individual trees are detailed. Results in the year of injection and in the two following years are tabulated and discussed. The injections were found to have remedied the chlorotic condition especially in the trees where the soil had been allowed to become overgrown with grass and weeds. [The author had already shown the good effects of grassing down in a previous paper. *Ibidem*, 1929, 7: 251-69.—ED.] Two points must be noted in this connexion:—(1) In certain plots the chlorotic conditions showed signs of reappearing in the third year. The fact that the actual doses were so small, ranging from 0·01 oz. per tree to 0·72 oz. (the last given through eight different holes in the case of a large Newton tree), suggests that they might be increased without danger and with increased duration of effect. (2) Special attention must be paid to the position at which the injections should be made. [See also *Ann. Appl. Biol.*, 1934, 21: 333-43, *H.A.*, 1934, 4: 2: 191.] The point is being tested in further experiments.

196. HÜLSENBERG, H. 631.542: 634.1/2
Wunden und Wundbehandlung an Obstbäumen. (**Pruning wounds and their treatment.**)
Gartenbauwiss., 1935, 9: 175-82, bibl. 3.

The author discusses the findings of Ebert and Zecha as to the best time and method of pruning. He then describes trials made by himself on the comparative merits of the following materials used to cover and protect the cut surfaces of pruned apple and plum trees:—Grafting wax, oil paint, enamel varnish, wood tar from various sources, anthracite tar, brown coal tar and a proprietary preparation called Corbin, normally used for pickling seed corn. He tabulates the progress in healing to be seen in the late autumn following treatment, and in the two succeeding autumns. In the first experiment on apples pruning was done on April 29th, a time when according to Zecha callus formation should be particularly good. The experiment was repeated on pruning wounds made even later, i.e. on June 19th on apples, while on plums the treatments were apparently applied to wounds made when pruning late in the previous autumn and left uncovered until treatment with various materials in the following spring. Grafting wax, oil paint and enamel varnish were found much the most satisfactory owing to their capacity for isolating the wounds, preventing their drying out and not hindering callus formation.

197. WEST, E. S., AND HOWARD, A. 634.1/8-1.67
The design of overhead irrigation systems.
Pamphl. Coun. sci. industr. Res. Aust., 50, 1934, pp. 39, bibl. 2.

The work discussed forms part of investigations undertaken at the Commonwealth Research Station, Griffith, N.S.W. The chief advantage of spray over surface irrigation lies in the greater control exercised over the amount and distribution of water applied. It also does away with the necessity on undulating land of preliminary grading and levelling operations, and on all areas of ditches which are necessary in surface irrigation and detract considerably from the surface capable of cultivation. Disadvantages are initial cost, cost of pumping water and depreciation of plant. Systems fall into two main groups, viz. :—(1) those which depend on distributing the water radially from sprinklers, and (2) those which depend on distributing the water from orifices placed in long pipes. More commonly systems are ruled by the former principle, the tendency being in California to use permanent sprinklers distributed throughout the area, and

in Australia to use portable pipes with sprinklers spaced along the pipes. The system in use at Griffith depends on the second principle and is a modification by Kook of the Skinner system. Briefly in Kook's modification water is distributed from main pipes to appropriately spaced laterals. The latter are 1-inch pipes of 26-gauge galvanized flat iron having a soldered lock seam, in which orifices are made by simply punching with an awl. The nozzles are all in the same plane and the effect is to discharge streams of water at right angles to the lateral and in a common plane. By twisting the laterals the land can be uniformly irrigated, the laterals being parallel and close enough to allow the whole surface to be reached by the jets. Precise details are given of the system, and the hydraulic factors involved are discussed at length from the mathematical standpoint. Costs of erection are studied and six schemes are considered in detail for the application of this type of irrigation to a hypothetical 20-acre orchard in which trees are planted on the square system at 22 feet apart. Appendix 1 gives constructional details of mains and laterals, appendix 2 describes methods used in hydraulic investigations of laterals, and appendix 3 shows how to use table 7, which is given previously and shows the relationships of pressures at distal and proximate ends of the laterals, lateral lengths and total quantity of water discharged by laterals for various pumping pressures.

Crop.

198. EDGAR, J. L., AND DE WET, A. F. 634.11-1.56
An experiment in sampling technique for size and colour of apples. Bramley's Seedling on rootstock No. II, 1934 crop.
Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 130-4, bibl. 2.

A quick but accurate sampling method is essential for testing the size and colour of fruit from experimental trees. Testing results on the same fruit against those obtained by longer and more laborious methods the authors were able to make the following statement :—(1) The crop was graded for size and colour taking each orchard box* separately, each tree filling about eight boxes. (2) "Sample" boxes, filled by taking an equal number of apples at random from each original box, were then taken from the total crop for each tree and these were graded separately for size and colour. (3) It was found that the "sample" boxes were sufficiently uniform to take one as representative of the crop of the whole tree. The same degree of accuracy was obtained by grading one "sample" box as by grading three of the original orchard boxes.

199. SHAW, J. K. 634.11-1.8
The life time yield of an apple orchard.
Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 35-8, bibl. 2.

The orchard referred to, consisting of 60 trees, was planted in 1889 and was partly grubbed in 1934. Four varieties were concerned, namely Rhode Island Greening, Roxbury, Baldwin and Gravenstein, their total yields over 32 years of cropping per tree per year being 11.4 bushels, 8.6, 8.2 and 7.0 bushels respectively, the soil being possibly rather too wet for Baldwin and Gravenstein. The management of the plots including pruning technique and manuring were changed at different times and the apparent results of such changes are briefly indicated. The most definite indication is that the yearly application of farmyard manure was responsible throughout for the heaviest cropping. The trees on the plot treated thus early attained greater size than those on the other plots which had received nil, wood ashes, bone and muriate of potash, or bone and sulphate of potash, but no manure, and they maintained this advantage throughout, though later in life yields tended to level up as the result of applying nitrogenous fertilizer to all the plots and probably owing to the trees beginning to crowd one another about this stage.

* The boxes referred to hold $1\frac{1}{2}$ bushels or approximately 40 lb. apples.

200. METLITZKY, S. A., AND KAMYAKOWA, A. K. 634.11
The principal causes of lowering of the apple's quality. [Russian-English summary.]

Trans. Cent. Res. Inst. Fruitgrowing, Mitchurin, 1935, 1 : 3 : 1-60.

The authors note the extremely low grade of marketed apples in the Woronej district. Cull apples were found on a 3-year survey to amount to 18-25%, and the greater part of those marketed were not better than second or third grade. They attribute this state of affairs largely to the following:—(1) scab injury, (2) injuries due to faulty picking and handling, mechanical injury when on the tree and injuries to fruit done by biting insects, (3) codling moth damage, especially to winter varieties.

The following also are noted:—

BROADFOOT, H. **Budding pome and stone fruit trees.** *Agric. Gaz. N.S.W.*, 1935, 46 : 101-4.

ROBERTS, R. H. **Leaf area and fruiting.** *Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 32.*

DORSEY, M. J. **Ice formation in the fruit bud of the peach.** *Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 22-7, bibl. 7.*

SAMISCH, R., AND OTHER. **Enzymatic darkening in apricots.** *Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 28-31, bibl. 10.*

HARDTL, M. Die Wirkung der mechanischen Inanspruchnahme auf die Bildung und Entwicklung der Blüten und ihre Bedeutung für den Fruchtertrag der Pflanzen. (**The effect of mechanical demand on the formation and development of blossoms and its importance to cropping.**) *Gartenbauwiss.*, 1935, 9 : 246-68, bibl. 43 (ca).

SMALL FRUITS, VINES, NUTS.

201. KEMMER, E., AND SCHUTZ, F. 634.7
Stand des Beerenobstbaues. (The small fruit industry in Germany and elsewhere.)

Landw. Jb., 1935, 81 : 85-127, bibl. 24.

The statistics available of the small fruit production of England, Holland, and the U.S.A. and of the imports and/or exports from those countries are considered and compared with figures for Germany. The labour requirements for growing strawberries, currants, etc., in Germany are next considered and set out graphically and the costs of establishing and running small fruit plantations are examined. Germany appears from the data presented to be considerably behind the other countries in question as regards her production of small fruit per head of population. The figures should certainly act as a useful guide to the would be small fruit grower in Germany with regard to the approximate outlay necessary.

202. BAILEY, J. S., AND FRANKLIN, H. J. 634.73
Blueberry culture in Massachusetts.

Bull. Mass. agric. Exp. Sta., 317, 1935, pp. 19, bibl. 9.

Present day blueberry cultivation in U.S.A. is based on the improved varieties developed by Coville from *Vaccinium corymbosum*. Cabot, an early variety, Pioneer, a mid-season variety and Rubel, which ripens a few days after Pioneer, are recommended for planting in Massachusetts, while Concord, Rancocos, Wareham and Jersey are considered worth a trial. The ideal soil is fertile, has a plentiful and continuous water supply, is well drained and aerated, well supplied with organic matter and is acid. To produce large berries plants must be kept in a highly vigorous condition. In *propagation*, which is done from cuttings, the following points should be noted. Drainage below the propagating bed to allow excess water to drain away and ventilation over the bed should ensure adequate aeration. The air over the bed must, however,

be kept moist enough to prevent the new growth from wilting, since top growth precedes root growth. Humidity can be maintained by the careful use of glass sash. Directly leaves are produced light is necessary and the shades should then be removed on cloudy days. Shading and ventilation are necessary to prevent overheating. Cuttings of 3 to 4 inches long and having no fruit buds should be taken in spring before the buds begin to break from wood of the previous season's growth. They should be set in German peat or other medium, vertically or at an angle of 45°, 1 inch apart in rows 2 inches apart. If planted so that only the top bud is above the surface, usually only this bud will grow out and a better plant will result. The buds should be watered thoroughly and the sash put in place. Shades are made of burlap or slats supported 4 inches above the sash. If any cuttings show signs of rooting, the frames must be ventilated by raising the sash slightly. Ventilation once started should be gradually increased. Cuttings may be left protected by straw, etc., in the cold frame during the winter. In the spring they should be set out in a nursery, where they remain for 2 years before transplanting to their permanent positions. *Planting out* is done at 5 feet between plants and at 8 feet between rows, 1,089 plants thus filling an acre. Clean cultivation is usually adopted at a depth of 2 to 4 inches between the rows and no nearer to the plants than the ends of the branches. Weed growth close to the plants can be controlled by hand hoeing. Blueberries respond to *manuring* from a year after planting and it is suggested that 500 to 600 lb. to the acre is a reasonable quantity of fertilizer to give at the time when the bushes begin to bear. The following mixture is advocated: 6.4 parts nitrate of soda, 6.4 concentrated tankage, 3 superphosphate, 4.2 sulphate of potash. This should be applied in the spring when growth is just starting. Little *pruning*, only removal of short weak branches, is necessary in the first two years, during which period no fruiting should be allowed. Pruning must later vary according to the position of the fruit buds which varies in different varieties. General principles recommended are:—(1) remove a few of the older branches, (2) remove branches so close to the ground that the fruit on them would otherwise be soiled, (3) remove short, weak shoots to prevent crowding, (4) cut back shoots with too many fruit buds. Common *pests* and *diseases* and their control are discussed. Finally hints are given on the improvement of existing wild blueberry areas.

203. ~~WALDO, G. F.~~
~~BROWN, G. M.~~

634.75

Investigations on runner and fruit production of everbearing strawberries.

Tech. Bull. U.S. Dep. Agric., 470, 1935, pp. 15, bibl. 8.

The trouble with everbearing strawberries in the past in the U.S.A. has been that they have generally failed to produce enough runner plants either for production in late summer or for further propagation. The experiments reported here took place between 1926 and 1931 and aimed at gaining information on growth characteristics which might lead to adequate production, both of fruit and runners. It was found that runner production was very greatly stimulated by the removal of flowers on appearance, the effect increasing the longer the practice is continued throughout the whole season. Runner production was also stimulated through July and August by removal of the runners themselves on appearance. Irrigation had an even greater effect, and under irrigation practically as many runner plants were produced by plants from which no flowers had been removed as by those having the flowers removed up to July 15th, August 15th or even throughout the season. Where, however, irrigation was not practised and the flowers were allowed to remain, not only was runner production small but also relatively little fruit was produced later in the season. Even under irrigation, flower and runner removal up to July 15th resulted in a decidedly greater yield during the rest of the season. Generally speaking the author considers that in regions of frequent summer droughts it is hard to get a good stand of runner plants early enough to get a paying crop of berries from them. In such regions the hill system of growing is the best. Where, however, there is adequate summer moisture or irrigation is available, runners should be allowed to form on varieties such as Mastodon. There is considerable difference in the runner and fruit forming characteristics of different everbearing varieties and these will always have to be considered in conjunction with environmental conditions before planting.

204. DARROW, G. M. 634.75
Increasing strawberry yields through plant spacing.
Better Fruit, 1935, 29:11:3.

Experiments with strawberries in Ohio and North Carolina indicate the desirability of wide spacing. A one year trial in North Carolina with Blakemore resulted in a higher yield being obtained by spacing at 9 in. between plants and 24 in. between rows than by any other spacing.

205. MOOG, H. 634.843
 Beiträge zur Ampelographie. VI. (A contribution to ampelography. VI.)
Gartenbauwiss., 1935, 9:293-324, bibl. 9.

The 26 vine varieties described here are mainly French hybrids and crosses originating at Geisenheim and now forming part of the collection at Tiefenbach. Illustrations of the leaves of each variety and notes of the most important vegetative characters are given in each case.

206. OLMO, H. P. 634.873:575.252
Bud mutation in the Vinifera grape. I. "Parthenocarpic" Sultanina.
Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31:119-21, bibl. 3.

A description is given of a small berried, straggly clustered mutant of this raisin grape. The vine is much more vigorous in growth than the true Sultanina (or Thompson's Seedless), hence arises the danger of choosing it when selecting cuttings from dormant vines. The author stresses the necessity for taking cuttings from vines whose fruit and habits are known to be normal.

207. BRIERLEY, W. G., AND ANGELO, E. 634.8-2.111
Winter killing of the roots of the Beta grape.
Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31:114-8, bibl. 2.

The Beta is a seedling directly derived from *V. vulpina*. Experiments were made for two years with rooted single-eye, 2-eye and 3-eye cuttings in the laboratory and in the open. The results are discussed. It was found that roots of young vines were severely injured or killed at about -12°C. both outdoors and in the laboratory. The worst injury outside occurred at a depth of 3 inches. The wood and callus of the original cutting will apparently stand cold much better than the roots. These parts apparently develop new roots much as a new cutting does if the year-old roots are killed off by cold. New growth became less vigorous in consequence of the prevention of intake of water and nutrients owing to loss of roots. Schrader's work, moreover, shows that in young Concord vines at any rate the greater proportion of the stored foods is in the roots. Loss of food resulting from the death of the roots would then naturally be followed by decreased vigour. Deeper planting and the use of cover crops are recommended as a preventive.

208. DUPUY, A. 634.8-2.13:631.542
 Retaille après grêle. (Re-pruning after hail.)
Progr. agric. vitic., 1935, 103:441-3.

Re-pruning after hail is only necessary if, the season not being too advanced, the crop is totally lost or nearly so, the leaves much torn and the branches much bruised. If re-pruning is not carried out when the vines are reduced to this state, they put out large quantities of feeble growth from the tips of the damaged branches with the result that these branches do not thicken sufficiently to provide suitable wood for winter pruning and to ensure the succeeding crop. Re-pruning makes certain that the sap is concentrated only in a few well placed growths. It is difficult to fix any definite date beyond which re-pruning should not be done; much depends on the weather and district. Instances are given where vines badly damaged by hail in the district of l'Aude were successfully re-pruned as late as July 10th. Vines which were too weak to react to the re-pruning or were subsequently neglected did not seem to have either benefited by or suffered from the operation when compared with vines which were not re-pruned. It is noted that these late re-prunings were followed by a long period of favourable weather.

There should be no delay in re-pruning, which should be completed within 10 days after the hail storms have passed. The operation consists in suppressing all the current year's growth except a few well placed shoots, which are cut back to the nearest uninjured bud from the base. This means a hard cutting back in all respects equal to that done in winter pruning. Old wood bare of vegetation may be unhesitatingly cut out. Unwanted shoots, especially those issuing from old wood, must be eliminated as soon as they appear. Spraying is necessary, the new growths being very susceptible to mildew. Weeds must be kept down. Much of the success of the re-pruning will depend on the after care received by the vines. In any case the crop of the succeeding year will suffer to some extent.

209. HAMOND, J. B.

634.51-1.53

The future of walnut propagation in England.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 239-41.

Walnut propagation at East Malling has since 1932 been almost entirely restricted to 7 English varieties, which were the most successful in the competition organized by the Royal Horticultural Society in conjunction with the Ministry of Agriculture in 1929, the French varieties Franquette, Mayette, Meylanaise and Treyve, and the American variety Woodland. [The last though bearing catkins earlier than the others is very susceptible to walnut blight and is no longer recommended, Meylanaise being advised instead.—ED.] Seedlings of *Juglans nigra* are at present used for most of the grafting, but seedlings of *J. regia*, which are more readily obtainable in this country, are now being tested and show considerable promise. Some vegetatively raised rootstocks are also being used on an experimental scale, the difficulty here being that *Juglans* species do not normally root at all readily from cuttings or layers. Four nursery firms have been supplied with young grafted trees of approved varieties, so that it should soon at last be possible to buy selected or named varieties of walnut for planting in England with some idea of their potentialities.

210. JOHANSSON, E.

634.54 : 581.162.3

Pollineringsförsök med hassel vid Alnarp 1927-33. (**Pollination of hazel nuts.**) [English summary.]

Contrib. Swedish Perm. Cttee. Orch. Res., 35, 1935, pp. 15, bibl. 5.

In Contribution No. 11 of the Swedish Permanent Committee a report was given on this subject. The present report deals with further studies. It is noted that considerable confusion in nomenclature exists. This is being cleared up. Of the varieties tested most were found to be quite or nearly self-sterile. Cross-pollination was generally successful especially when carried out by types of the wild hazel, *Corylus Avellana*. It appears that groups of inter-sterile and incompatible varieties are found. Tables are given which demonstrate this feature as affecting a large number of common varieties.

211. THOR, C. J. B., AND SMITH, C. L.

634.521 : 581.192

A physiological study of seasonal changes in the composition of the pecan during fruit development.

J. agric. Res., 1935, 50 : 97-121, bibl. 35.

Samples were taken from trees of the Burkett and Stuart varieties growing near Austin, Texas, U.S.A., on 11 occasions between May 18th and November 14th, 1932, the first date being 5 weeks after full bloom. The methods of sampling and analysis are described. The two varieties gave similar results. Growth of the nut until early September was characterized chiefly by the formation of structural elements of the shuck and shell. Thereafter filling of the kernel was of major importance. Most of the oil, protein, mineral and acid-hydrolysable polysaccharide content of the kernel developed during September. Nearly all the sugar content of the kernel, being almost exclusively in a non-reducing form, appeared in the first half of

October. There are indications that much of the sugar in the mature kernel may be the result of translocation from the shuck during the later stages of ripening. Premature harvesting of pecans, i.e. before they are ready to fall, would appear to prejudice the quality of the nut. [From authors' summary.]

The following also are noted :—

BRIERLEY, W. G. **Winter desiccation in the Latham raspberry.** *Proc. Amer. Soc. hort. Sci. for 1934*, 1935, 31 : 110-13.

BÖRNER, C., and SCHILDER, F. A. Beiträge zur Züchtung reblaus- und mehltaufester Reben. (Notes on the breeding of vines immune to phylloxera and mildew. I. Foreword. II. The behaviour of the leaf phylloxera with regard to the vines of the Naumburg selection.) *Mitt. biol. Anst. (Reichsanst.) Berl.*, 1934, Heft 49, pp. 84.

PLANT PROTECTION OF DECIDUOUS FRUITS.*

212. CHRISTOW, A. 634.11-2.8
Mosaikkrankheit oder Virus-Chlorose bei Äpfeln. (A mosaic disease of apples.)
Phytopath. Z., 1934, 7 : 521-36, bibl. 5.

The disease described here was found by the writer in the Bulgarian State nurseries at Pawlowo near Sofia in 1930. For the next four years attempts were made to isolate the supposed organism responsible. Though many organisms were isolated from the diseased tissue, not one was found capable of inducing the disease in healthy apple tissue. In 1933 it was proved that, though none of the suspected fungi or bacteria were responsible, it was possible to infect trees by grafting from an infected shoot and it was concluded that a virus was the cause of the trouble. The virus diseases reported on apples from America appear to differ from that found in Bulgaria. The latter is said to be noticeable in nearly every nursery in Bulgaria. It is characterized by light green, polygonal mosaic spots over the whole leaf surface. These symptoms are undoubtedly most prominent on wild apple seedlings. On young budded trees the most often noticed and most characteristic form is a chlorosis which is accompanied by the scorching of the leaf and often by the total drying up of the plant. A necrosis occurs at the same time, starting at the root tip and attacking the base of the main root and stem. The necrotic areas so formed are then attacked by fungi which hasten the death of the tree. It would appear that a certain number of the young trees survive. Some of these will in the succeeding years show symptoms of chlorosis while on others the leaves will grow quite normally but show a few spots of mosaic. Experiments have now been started to determine whether trees so diseased bear fruit showing bitter pit.† A similar disease with like symptoms can be seen in pears, quinces, apricots, peaches and plums.

213. HARRIS, R. V. 634.711-2.8
Some observations on the raspberry disease situation in North America.
Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 156-64.

The raspberry disease situation in Eastern Canada and U.S.A. with special reference to virus is briefly discussed by the author on the basis of observations and a year's residence at St. Catharine's, Ontario. Conditions are compared with those obtaining in the Canadian West and in England and notes are given on official efforts to combat the inroads of virus diseases, including the Dominion Government Certification Scheme and work directed to the breeding of immune strains.

* See also 181, 207, 208, 303, 305, 325.

† See Atanasoff, D., *Virus diseases of plants*, *A bibliography*, abstr. *H.A.*, 1934, 4 : 3 : 494.

214. MASSEE, A. M. 634.75-2.8 + 632.654.2

On the transmission of the strawberry virus "yellow edge" disease by the strawberry aphids, together with notes on the strawberry tarsonemid mite.
J. Pomol., 1935, 13 : 39-53, bibl. 11.

The trials here described were carried out on originally healthy, uninfected and uninfested Royal Sovereign plants all raised vegetatively from one clone. Plants were grown separately in 7-inch pots which were plunged in the soil in rows in 6 bays. Each bay contained 30 plants. In the centre were two control bays where the plants were not inoculated. Inoculations were made on to the plants in the remaining 4 bays of (1) mites from virus free plants, (2) mites from virus infected plants, (3) aphides from virus free plants, and (4) aphides from virus infected plants. The direct inoculations began on June 5th and were continued at weekly intervals till July 21st, 5 aphides and 5 mites being transferred to their respective plants on each of those 7 occasions. The transfers were made with a small camel hair brush under a binocular microscope. By the end of June the direct effect of the feeding of the aphides and the mites became apparent upon the plants. It was noticeable in the case of mite transference that the infestation was more severe where the mites were taken from healthy plants than where they were taken from unhealthy plants. A survey was made at the end of July and again in the first weeks of September. Results showed that the strawberry aphid, *Capitophorus fragariae* Theo. (= *Pentatrichopus potentillae* Wlk. ?), is a vector of yellow edge. It can transmit it in June, but the evidence so far tends to show it cannot do so in the latter part of July and in August. One hundred per cent. (30 plants) of healthy plants showed virus symptoms when inoculated with aphides-from-virus plants. Only one plant out of 30 showed virus symptoms when inoculated with aphides-from-healthy plants and this infection is thought to have been due to the wandering of an infected aphid from the adjacent bay. One hundred per cent. of the control plants remained healthy throughout the trial. Direct aphid injury showed characteristic symptoms, but caused no material damage. The mite (*Tarsonemus fragariae* Zimm.) did not transmit the virus in these trials, negative results being obtained in both bays. It is shown, however, to cause serious direct damage, which may mask virus symptoms if present. The technique whereby these insect transmission experiments could be successfully conducted in the open, without the help of an insect-proof greenhouse, is described.

215. CHAMBERLAIN, E. E. 634.75-2.8

A virus disease of strawberries in New Zealand.

N.Z.J. Agric., 1934, 49 : 226-31, bibl. 10.

From studies made in New Zealand from 1931-34 a virus disease is considered to be one of the causes of degeneration of strawberries in that country. It is suggested that the virus may be similar to that described by Plakidas in North America as "xanthosis", and in England by Harris as "yellow-edge". Witches broom and crinkle, however, appear to be quite distinct diseases. Two series of experiments show that the vector of the virus is the strawberry aphid, *Capitophorus fragariae* Theo. The virus symptoms appeared on healthy plants four months after the initial inoculations of aphides from diseased plants to healthy plants had been made. Other methods of artificial inoculation gave negative results. The chief symptoms of the disease are :—A marked stunting of the plant, the development of small leaves with short petioles, and a yellowing of the foliage.

A.M.M.

216. WORMALD, H. 632.314 : 634.22

Preliminary laboratory tests of bactericides on the plum bacterial canker organism.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 151-5.

It is thought that bactericides may be useful in the following ways :—(1) painting over pruning or similar wounds, (2) spraying foliage in summer or spring for protection against the "leaf spot" stage, (3) autumn spraying to prevent stem and branch infection by the canker stage. Preliminary tests are described with nearly a dozen common bactericides for their bacteriostatic (growth inhibiting) and bactericidal effect on *Pseudomonas mors-prunorum*. The fungus is found to be very sensitive to low concentrations of most of the substances used.

217. MILLER, P. W. 634.51-2.314

Walnut blight and its control in the Pacific Northwest.

Circ. U.S. Dep. Agric. 331, 1934, pp. 13.

Loss due to *Phytophthora* (or *Pseudomonas*, or *Bacterium*) *Juglandis* may sometimes amount to 50 to 60 per cent. of the crop. The symptoms of its attack are discussed and control measures and application technique explained. The following dusts have been tried without success:—copper lime (20 per cent. monohydrated copper sulphate and 80 per cent. hydrated lime), dehydrated bordeaux dust (12 per cent metallic copper +2 parts hydrated lime), 3 types of flotation sulphur dust, and a proprietary gas-house colloidal dusting sulphur. The following treatment is recommended. Cover leaves and nuts with thorough coating of 2-2-50 bordeaux spray, making 3 applications:—(1) just before most of the female flowers come into full bloom—a summer oil emulsion or a highly refined summer spray oil may be added to reduce leaf burn in the proportion of 1 gallon oil to 100 gallons spray; (2) when most of the flowers have been pollinated and nuts are about the size of small peas; (3) about 10 days later (only if necessitated by abnormally wet weather).

218. HAMILTON, J. M. 634.11-2.42

Studies on apple scab and spray materials for its control in the Hudson Valley.

Tech. Bull. N.Y. St. Agric. Exp. Sta. 227, 1935, pp. 56.

The ascospores of the apple scab fungus, *Venturia inaequalis*, may be discharged (in the Hudson Valley) from the middle of April to the last week in June. Spray materials used to control scab can be classified into those that are protective and eradivative such as limesulphur, and those that are merely protective such as wettable sulphurs, sulphur dusts and copper sprays. Wettable sulphurs have given good results only when applied at appropriate times, otherwise serious scab has developed. Compared to lime sulphur more frequent applications would seem advisable. The most satisfactory results can only be obtained by a diversified programme, since each material has its own merits and limitations. Choice of material depends on the incidence of scab, the relationship of the last infection period to the stage of host development at the time it is to be applied, weather, variety, time of year and general orchard practice. The presence of fine sulphur in a given material is obviously the major consideration in determining its effectiveness and the concentration at which it should be used, but thoroughness or frequency of application, rainfall and varietal leaf and fruit characteristics and rate of growth must be considered. Texture of the apple cuticle and rate of growth are vital considerations in the arsenical residue problem. [When combination insecticide-fungicide sprays are used.—Ed.] Amounts of arsenic retained on the fruit were found to vary with the different fungicides used. The material that leaves the least sulphur residue on the fruit may leave the greatest arsenical residue and vice versa. Although laboratory tests indicate that sulphur and copper are toxic to apple pollen, the practice of spraying during bloom for scab control appears commercially feasible, provided one or at most two good pollination days have occurred prior to spraying. [From author's abstract.]

219. COLE, J. R. 632.42 : 634.521

***Gnomonia nerviseda*, the perfect stage of the fungus that causes the vein spot disease of pecan foliage.**

J. agric. Res., 1935, 50 : 91-6, bibl. 5.

This disease is strikingly like pecan scab (*Cladosporium effusum* (Wint) Demaree) so that a casual examination will not always distinguish between them. The author gives a detailed description of this species of *Gnomonia*, differentiating it from others already found on pecans and suggesting the name given in the title in view of his having found it to be the perfect stage appearing in the spring of the vein spot fungus, *Leptothyrium nervisedum*.

220. MONTGOMERY, H. B. S., AND MOORE, M. H. 632.952

On a new method for precision testing in the laboratory of the toxicity of lime sulphur and of bordeaux mixture as protective fungicides.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 217-22.

The test fungus in use for provision of spores is *Venturia inaequalis*; the fungicides are lime sulphur and bordeaux. Notes are given on the method as evolved to date, the technique being still in process of development.

221. WORMALD, H. 632.42 : 634.22

Further studies of the brown rot fungi. VII. A shoot wilt in stools and layer beds of plum stocks and its relation to wither tip.

J. Pomol., 1935, 13 : 68-77, bibl. 5.

A shoot wilt was noticed in the stool beds and layer rows of the plum rootstock varieties being raised at East Malling in 1934. Myrobolan A was free from the infection, and the other myrobolans were not seriously affected. The most severely infected variety was black damas D. *Sclerotinia laxa* was isolated from the tissues of lesions found on the underground parts of the affected shoots. Typical wither tip symptoms caused by the same fungus were also found in the case of some of the stools of mariana, broad leaved mussel and pershore. Inoculations showed that both the above conditions could be reproduced by infecting leaves with conidia of the fungus. The author recommends that stool and layer beds of plum stocks should be as far away from established plum and cherry trees as possible owing to the very strong indications that the wilt disease in such beds is chiefly caused by spores of *S. laxa* falling on leaves which are later covered with soil during the normal earthing up process. The fungus is a common parasite in the flowers and fruits of plum and cherry trees and on plums it also infects the leaves and young shoots. Fungal fructifications have not been found on the underground lesions, which means that the dead shoots are not themselves sources of infection. But if lesions occur on the above ground parts, *Monilia* fructifications may develop on the dead tips and shed their spores into the air. Hence any shoots showing the wither tip conditions should be cut back or pulled out.

222. HAHN, G. G. 634.722-2.452

Immunity of Viking, a Norwegian red currant, to *Cronartium ribicola* and *C. occidentale* under greenhouse conditions.

Circ. U.S. Dep. Agric., 330, 1935, pp. 16, bibl. 10.

The Viking belongs to the *Ribes petraeum* group of currants. Bushes are very vigorous and upright and more healthy and resistant to the currant worm than others. Its fruit is of medium size, not very dark, but very attractive. It is a late variety. It was found in Scotland under greenhouse conditions to be immune to aeciospores of British strains of *C. ribicola* from *Pinus monticola* and *P. Strobus* in 1929, and since then it has proved immune, under similar conditions in the U.S.A., for 4 years to aeciospores and urediniospores of American strains of *C. ribicola* from *P. strobus* and to aeciospores of *C. occidentale* on *Pinus monophylla*. Field tests instituted in 1932 had up till 1933 inclusive shown no breakdown of this immunity.

223. HILDEBRAND, A. A. 633.88-2.48

Root rot of ginseng in Ontario caused by members of the genus *Ramularia*.

Canad. J. Res., 1935, 12 : 82-113; bibl. 25.

Two destructive root diseases of ginseng (*Panax quinquefolium* L.) are investigated. In the more destructive of the two the affected roots may entirely disappear in the soil and leave only a peridermal shell enclosing fragments of vascular tissue. This disease, which is non-systemic, is shown to be caused by at least three representatives of the genus *Ramularia* of the Fungi Imperfecti. One of these has been identified as *R. panacicola* Zins, the other two are new to science and have been named *R. mors-panacis* and *R. robusta*. They persist in the soil indefinitely. No sexual stage has been observed. The second and less serious disease is a rust, the cause of which has not been discovered, though this too is probably due to a *Ramularia*. Experiments in control by steam sterilization of soil have given good results but are impracticable.

in the case of large areas. Experiments with soil disinfectants have given contradictory results. During the investigation sufficient evidence was obtained of the universal occurrence and parasitic capabilities of a large number of additional representatives of the genus *Ramularia* to change the concept of this genus, and the author holds that it must be considered an important member of the group of facultative parasites associated with root troubles of plants.

224. MOORE, M. H., AND MONTGOMERY, H. B. S. 632.951/952

A field spraying trial of combined fungicide-contact-insecticide sprays in 1934.

Ann. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 208-16, bibl. 4.

Effective control was achieved by the use of mixed sprays used on sufficient occasions—which are noted—of apple scab, apple sawfly and red spider. The effects of treatment on other pests such as winter moth, codling moth etc., were less noticeable partly owing to the small incidence of these pests. Particulars of sprays and wetters used, times of spraying and results are given.

225. LOEWEL, E. L. 634.22-2.95

Die Spritzung der Pflaumen u. Zwetschen unter besonderer Berücksichtigung der Verträglichkeit der einzelnen Sorten mit den gebräuchlichen Spritzmitteln.

(Spraying plums with particular note of varietal susceptibility to spray damage.)

Gartenbauwiss., 1935, 9 : 189-204, bibl. 9.

The author discusses the results of 4 years' experiments "on all sorts of plums and damsons" in the fruit districts of the lower Elbe carried out by the Altenland Research Group. The chief pests are *Hyalopterus arundinis*, *Cheimatobia brumata*, *Hyponomeuta malinellus* and *Tetranychus telarius*. Carbolineum (8% solution) was found to destroy the pests but at the same time to cause bud fall and great loss of crop. Winter spraying with a 6% tar oil wash—of the type in which fractioning occurs above 270° C.—when the buds were still dormant proved successful. Its effect was increased by the addition of bordeaux mixture. The addition of lime sulphur, moreover, at 6-10% concentration helped considerably in the control of red spider and the mealy plum aphid. Post blossom spraying is chiefly done to control plum sawfly and red spider and here 2% lime sulphur is recommended. Copper arsenate, lime sulphur-calcium arsenate and lead arsenate preparations should be avoided as they damage the trees. Lime sulphur-lead arsenate is only successful when it is sprayed at petal fall and the trees are very thoroughly covered. Many varieties of plum cannot stand this and its use is therefore hazardous. [Examples cited are Frühe Fruchtbare, Zimmers Frühzwetsche, Greengage and Wilhelmina Späth.—Ed.] One year's trials suggest that a proprietary spray called Lianol gives equally good effects and does no damage irrespective of the time at which it is used.

226. MARTIN, H. 632.951.8 + 632.951.4

The standardization of petroleum and tar oils and preparations as insecticides.

Ann. appl. Biol., 1935, 22 : 334-414, bibl. 74.

Agreed specifications together with agreed methods of analysis of some of the simpler materials used as insecticides and fungicides have been issued in *Bulletin 82 of the Ministry of Agriculture, London*, published in 1934. Among those not dealt with in this publication are the various types of spray fluid which contain tar and petroleum oils. As a result of discussions at a Conference of Advisory Entomologists held in December 1933 the author undertook to draw up draft specifications and methods of analysis for the tar-distillate and mineral oil washes and mixed oil washes. In this paper he shows how the method of specification may be made to include these materials. Specifications are here put forward in order to see how they will work out in practice. Suggestions made are necessarily based on the published information on the subject of which indeed full use is made. Petroleum oils, tar oils and combinations of the two are considered in turn, their insecticidal and phytocidal actions discussed and recommendations made with regard to suitable specifications, based on the physical and chemical criteria which actually determine their value for the different uses in the field. The author suggests that to cover all requirements a minimum of 5 grades of the oils themselves is necessary, 2 of tar and 3 of petroleum oils. He defines these grades stating the purpose for which the particular grades

are intended. Suitable methods of emulsification being necessary for the successful use of these oils, it is more customary for the fruitgrower to use in preference manufactured oil preparations which need only the addition of water. Specifications are accordingly also suggested for such tar and petroleum oil preparations to cover all present needs. Methods of analysis are suggested to determine the various criteria required by the specifications. The application of the specifications is illustrated from oils and preparations already in use. This first attempt at an exhaustive survey of available information and the recommendations based thereon should go far to satisfy a need long felt by all users of petroleum and tar oil washes.

227. FREAR, D. E. H. 632.951.23 : 634.11

Spray residue removal in Pennsylvania.

Penn. St. hort. Assoc. News, 1935, 12 : 67-9.

The permitted tolerance for arsenical spray residue is 0.010 grain per pound ; for lead 0.019 grain per pound. By the proper timing of cover sprays it should be possible to keep the residue at harvest below 0.020 grain for arsenic and 0.040 grain per pound for lead. A cold 1.5 per cent hydrochloric acid wash used in a flotation washer should then bring the total residue below tolerance except in the case of waxy skinned varieties of apples for which the same solution heated to 100° F. should prove effective. These recommendations will not prove effective if any considerable amount of oil is used with the cover sprays.

228. GREENSLADE, R. M. 632.753 : 634.11

Laboratory trials of wetters against woolly aphid (*Eriosoma lanigerum* Hausm.)

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 185-90.

Of some 10 wetters used Agral II at 0.5 per cent. in connexion with nicotine as the toxic agent seems to be the only substance worth further trial in the growing season. In the laboratory test equal "tufts" of wool were floated on the solutions in watch glasses. Agral II had completely wetted its "tuft" in 40 minutes, whereas none of the others showed signs of wetting under 60 minutes. The phytocidal properties of the sample used are not known, but an earlier sample when used at 0.1 per cent. with lime sulphur was found to cause severe cracking and russetting of fruit. The author suggests that, if the preparation can be modified to remove this effect and a concentration of 0.5 per cent. can be used economically, it should offer promise in woolly aphid control. Preliminary trials against *Tarsonemus fragariae* are mentioned.

229. STEER, W., AND THOMAS, F. J. D. 632.768 + 632.793

Field spraying and dusting trials on the control of apple blossom weevil and of apple sawfly in 1934.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 194-204, bibl. 10.

A derris dust (rotenone content 0.36 per cent.) reduced blossom capping due to *Anthonomus pomorum* by 50 per cent., whereas a barium silicofluoride was ineffective. The eggs remained unkilld by nicotine. With regard to *Hoplocampa testudinea* last season's findings were confirmed:—(1) The eggs are very susceptible to nicotine and the addition of nicotine to the petal fall lime sulphur spray gives good control. (2) Derris reduced sawfly damage but is inferior to nicotine applied as above. (3) Derris dust controls the migrating larvae and so prevents secondary damage. As a petal fall spray lead arsenate, either alone or in combination with lime sulphur, was less effective than lime sulphur + derris (with a wetter). [From authors' summary.]

230. GREENSLADE, R. M., AND OTHERS. 634.11 : 632.768 + 632.78

Apple blossom weevil experiments in 1934. Impregnation of tree banding materials.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 180-4.

Corrugated cardboard bands were impregnated with a series of solutions in trichlor-ethylene and other solvents of chlorinated naphthalene waxes, made by Imperial Chemical Industries Ltd.

but not yet on the market, and were then put on the poles and trees of a cordon apple orchard. Notes are given on the ease of handling the differently treated bands. None of the treatments proved harmful to bark or trunk. Some of them were found actually to attract weevils, some to attract the larvae of the codlin moth. None were repellent to codlin moth larvae, though some were to weevils. In the attempt to find bands which will be distasteful to vermin and at the same time attract or at least not repel weevils or codlin moth larvae, several of the treatments will be repeated on a field scale in 1935.

231. THOMAS, F. J. D. 632.78 : 634.11

Preliminary experiments on the control of apple surface-eating tortricid larvae.

Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 205-7, bibl. 2.

Derris and soap about 9 weeks after petal fall reduced damage due to *Cacoecia podana* Scop. by 50 per cent. in a preliminary field trial.

232. DUMBLETON, L. J. 634.11-2.752

The apple leaf-hopper (*Typhlocyba australis* Frogg.)

N.Z. J. Sci. Tech., 1934, 16 : 30-8, bibl. 16.

The ordinary control methods recommended are nicotine 1-800 applied to the lower surface of the leaves when the insect is in the wingless stage. The possibility of biological control is discussed and notes are made on known parasites.

233. TYDEMAN, H. M. 634.11-1.541.11-2.753

Apple rootstocks immune from woolly aphid. A progress report on trials with new varieties.

Annu. Rep. East Malling Res. Sta. for 1934, 1935, A18, pp. 115-22, bibl. 8.

Since 1924 2,300 seedlings have been raised and tested for immunity and about $\frac{1}{3}$ have been found definitely immune. At first crosses were made between Northern Spy and various members of the so-called "Paradise" group, but now the work has been considerably extended to include among the parents such immune varieties as Transparent de Croncels, Winter Majetin and others. Briefly the characters tested in these potential stocks are immunity, ease of propagation by stooling, compatibility and capacity for imparting vigour and fruitfulness to the scion. Of the seedlings which have as yet passed the immunity test only 4 (Spy \times II raised at Merton in 1924) have been propagated in sufficient numbers to be included in trials worked with Lane's Prince Albert. They are known as Merton 778, 779, 789 and 793. They have been under such trial at Malling since 1930, while small batches have been sent to the Argentine, Australia, Canada, India, Morocco, New Zealand, South Africa and Russia, where their resistance to woolly aphid is being tested under widely differing circumstances. The results of the Malling cultivation trials since 1930 on scion worked trees, expressed in vigour of scion (wood growth and stem diameter), in number and character of blossom trusses, and in number and weight of fruits are discussed and summarized. Under conditions of the trials they have all proved more vigorous in their influence on the scion than Malling IX and less productive of blossoms and fruit in their early years. Numbers 793 and 779 would appear to be less vigorous in their influence than 778 and 789.

234. JANCKE, O. 632.753 : 632.96

Zur Ausbreitungsfähigkeit der Blutlauszehrwespe *Aphelinus mali* Hald.

(The possibility of spreading *A. mali*.)

Arb. physiol. angew. Ent., 1934, 1 : 101-9, bibl. 13.

The author considers briefly work published by himself and others dealing with the movement of *Aphelinus mali* from the places where it has been introduced. The data are set out clearly, but it is difficult at present to derive therefrom any definite ruling as to the exact causes of the spread or persistence of this parasite. Its continued existence would appear to depend on the working of a number of factors including weather conditions, e.g. wind, humidity, drought, physical features such as closeness of planting, availability of the woolly aphid host, etc.

235. MASSEE, A. M. 634.75-2.753
Notes on the strawberry aphid* (*Capitophorus fragariae*† Theo.)
Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 173-6, bibl. 5.
 and,
 THOMAS, F. J. D. 634.75-2.753 : 016
Bibliography of papers dealing with aphids on strawberries.
Ibidem, pp. 177-8.

The observations recorded here were made by the author in the greenhouse and in the open in Kent from November, 1933, onwards. The aphid was found capable of forming colonies in various host plants under glasshouse conditions, *Fragaria vesca*, *Potentilla sterilis* and *P. anserina* being apparently particularly preferred by the insect. In the open, however, during the course of these observations, it was not found on these or other weeds growing in a quite neglected Royal Sovereign plantation planted 5 years ago and left uncultivated. The egg stage of the aphid is as yet unknown. The appendix provides a useful list of 50 references, taken mainly from the *Review of Applied Entomology*.

236. AUSTIN, M. D., AND OTHERS. 632.754 : 632.951.4
Control of the common green capsid bug‡ : with special reference to the use of tar-petroleum oil winter washes.
J. Minist. Agric. Lond., 1935, 41 : 1195-1205, bibl. 13.

The authors review previous work on the subject dividing it into work done before and after 1931. Work prior to 1931 indicated that nicotine dusts and washes cannot be recommended for the control of this capsid and that commercial brands of tar oil washes even at 10% concentrations are also unsatisfactory. Work since 1931 on the ovicidal properties of various tar and petroleum oils have shown that certain relatively cheap, semi-refined petroleum oils are as toxic to the eggs of the capsid as are the highly refined and more expensive oils. A concentration of 6% of a suitable petroleum oil in a wash will give complete and a concentration of 4.5% a very high degree of control even in severe infestations. As an outcome of this work a wash of definite composition, cheaper than those previously suggested, can be recommended and has indeed been successfully used for the past 3 years by a number of Kent fruit growers. This wash can safely be applied to red and black currant bushes up to the middle of February. The wash is prepared from tar oils conforming to a specification for grade A oils and from petroleum oils conforming to a specification for grade E oils [both of which are given.—ED.] by means of a two-solution method using oleic acid and caustic soda as emulsifiers. An alternative method of emulsification is given for use with types of water for which the two-solution oleic acid method is unsuitable.

237. STEER, W. 632.76 : 634.71
Studies on *Byturus tomentosus* Fabr. V. 1934 : experiments on the control of the raspberry and loganberry beetle.
Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 191-3, bibl. 4.

The derris root used contained 3.63% crude or 2.92% re-crystallized rotenone. As a spray it was used at the rate of 2 lb. per 100 gall. As a dust it was mixed with china clay. A single application of dust late in May failed to give satisfactory results on raspberries. On logans derris gave satisfactory results§ when incorporated in a lime sulphur + sulphite lye or in a colloidal copper + sulphite lye or with soap when sprayed on June 22nd at the rate of 2 lb. derris, 2 gall.

* See also Abstract No. 214.

† The author notes that this may be the same as the American species *Myzus fragaefolii* Cockll. and that probably both should be referred to as *Pentatrichopus potentillae* Wlk. The systematists must decide the point.

‡ *Lygus pabulinus* Linn.

§ The main object of this trial was to find to what extent loganberry cane spot (*Elsinoe veneta*) can be controlled by including a fungicide in the late June "beetle spray".

lime sulphur, 2 pints colloidal copper,* 6 pints sulphite lye to 100 gall. water. A single application of derris and soap again satisfactorily controlled the pest on cultivated blackberry, thus confirming last year's results.

238. METZGER, F. W., AND OTHERS. 632.76 : 581.192
The relation of the sugar content and odour of clarified extracts of plants to their susceptibility to attack by the Japanese beetle.
J. agric. Res., 1934, 49 : 1001-8, bibl. 3.

Extracts of plants immune to the Japanese beetle having been found not to contain apparently any substances repellant to the beetle the line of enquiry was changed to a consideration of the possession by non-immune plants of substances definitely attractive to the beetle. Material from 97 species and varieties of plants including apple, peach and plum was accordingly analysed for reducing sugar content. The odour imparted by the plant material to the clarified extracts as well as the sugar content appears to be a significant factor in immunity or susceptibility. Of the plants whose clarified extracts were marked by a fruity odour 70.9% of those with a reducing sugar content of 15 to 30 mg. per gram of plant material and 46.7% of those with a smaller sugar content were seriously infested. Of those without the fruity odour the corresponding percentages were 21.5 and 18.2.

239. MILES, H. W. 632.793 : 634.22
The plum fruit sawfly and its control.
J. Minist. Agric. Lond., 1935, 42 : 129-33, bibl. 7.

In this short practical article the author traces the life history of *Hoplocampa flava* as affecting plum fruits. He notes that there is considerable difference in the extent to which varieties are attacked, observations in various parts of the country in different seasons showing that early flowering are less liable than late flowering varieties. Various methods of control have achieved a fair measure of success. Thus German experiments indicated that some control might be obtained by spraying 8 days after petal fall and again 8 days later with a lead arsenate and nicotine sulphur spray. Petherbridge also got promising results in 1933 with 2 applications of a spray containing lead arsenate, nicotine sulphate and a spreader. Trials in Lancashire in 1934 showed that considerable control was obtainable by the use of a spray containing 8 oz. nicotine and a spreader to 100 gall. water applied about 10 days after petal fall and repeated within the week. The author suggests that nicotine sulphate as used by Petherbridge might have a more lasting effect than nicotine and spreader and so be preferable. The time of application is all important.

240. TUFTS, W. P., AND DAY, L. H. 634.1/2-2.651.3
Nematode resistance of certain deciduous fruit tree seedlings.
Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 75-82, bibl. 2.

Results of observations made between 1928 and 1934 on nematode resistance of a large number of peach and nectarine seedlings are tabulated. The majority proved susceptible to a greater or less degree. Seedlings of some 48 varieties of apricot were found quite free during a 2 to 3 year test. Among plums a fair number showed great resistance, including rooted cuttings of St. Julien E† and G† and myrobolan B.† A 2 year test showed no infestation of mazzard and Stockton morello cherries but a moderate infestation of mahaleb. None of the 10 cultivated pear varieties was free from infestation. The 9 quince varieties tested, including †A, C, and D stocks, remained uninfested during the two years of observation. Nearly all the 1 to 3-year-old almond seedlings tested, including 2 "bitter" seedlings, showed considerable susceptibility. A few very vigorous ones kept free from knots and are being kept under further observation.

* A spray fluid based on copper oxychloride.

† So named during stock selection trials at East Malling, England.

The following also are noted :—

MINISTRY OF AGRICULTURE. **Apple and pear scab.** *Advis. Leaflet. Minist. Agric. Lond.* **245**, 1935, pp. 8.

MINISTRY OF AGRICULTURE. **The silver leaf disease of fruit trees.** *Advis. Leaflet. Minist. Agric. Lond.* **246**, 1935, pp. 8.

WORMALL, H. **The development of scab in stored apples.** *Annu. Rep. East Malling Res. Sta. for 1934*, **A18**, 1935, pp. 232-5, bibl. 10.

HARRIS, R. V., AND OTHERS. **Present day strawberry problems at East Malling.** *Annu. Rep. East Malling Res. Sta. for 1934*, **A18**, 1935, pp. 229-31.

FOLSOM, D. **Apple spraying and dusting experiments 1928-32 in relation to scab, yield and tree growth.** *Bull. Me. agric. Exp. Sta.* **368**, 1933, pp. 501, bibl. 141.

RIPLEY, L. B., AND OTHER. **Adhesives for cryolite suspensions.** *Sci. Bull. Dep. Agric. S. Afr.*, **122**, 1934, pp. 12.

HADLEY, C. H., AND OTHER. **General information about the Japanese beetle in the United States.** *Circ. U.S. Dep. Agric.* **332**, 1934, pp. 22. This does not deal with control measures.

SMITH, R. H., AND PERSING, C. O. **Nicotine vapor in codling moth control.** *J. econ. Ent.*, 1934, **27** : 1192-5.

GREENSLADE, R. M. **Observations on woolly aphis (*Eriosoma lanigerum* Hausm.) in 1934.** *Annu. Rep. East Malling Res. Sta. for 1934*, **A18**, 1935, pp. 236-8, bibl. 3.

DUMBLETON, L. J. **The woolly aphis of pear (*Eriosoma lanuginosum* Htg.).** *N.Z. J. Sci. Tech.*, 1934, **16** : 167-8, bibl. 4.

DUMBLETON, L. J. **Note on pear midge (*Perrisia pyri*) parasite (*Misocyclops* sp.).** *N.Z. J. Sci. Tech.*, 1934, **16** : 163-4, bibl. 4.

VEGETABLE GROWING.

241. BEATTIE, W. R. 631.544
Hotbeds and cold frames.

Fmrs.' Bull. U.S. Dept. Agric., **1743**, 1935, pp. 28.

Practical notes are given on the construction, ventilation and general treatment of the following : manure hotbeds, hotbeds heated by fuel, flues, hot water pipes, electric cables and cold frames. The use of different types of covering, e.g. glazed sash, cloth, etc., is discussed. Finally, notes are given on the sowing of early crops of tomatoes, peppers, eggplants, summer squashes, cucumbers, muskmelons, lettuces, cabbages, broccoli, cauliflowers and celery.

242. HORSFALL, J. G. 631.462 : 631.588.1
Pasteurizing soil electrically to control damping off.

Bull. N.Y. St. agric. Exp. Sta. **651**, 1935, pp. 8.

The author gives a brief account of trials with experimental models holding 1 cubic yard of soil. They are still in process of change and improvement, but the system has already been shown to have one distinct advantage over the old method of steam sterilization, namely that soil can be heated in the electric pasteurizer to a relatively low temperature (between 45° to 50° C.) and be allowed to cook for 12 hours or more without additional heat. This saves expense and does not injure the soil as steaming does. In experiments satisfactory control was obtained of damping off caused by *Pythium ultimum*, *Rhizoctonia Solani* and *Botrytis* sp.

243. JONES, H. A., AND EMSWELLER, S. L. 581.162.3 : 635.25

The use of flies as onion pollinators.

Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 161-4, bibl. 3.

The technique adopted for propagating and introducing the flies is described. Beef lungs are provided for egg laying, the larvae hatch out here, and after feeding fall into a pan below covered with sand in which they pupate. The pupae are separated out daily by screening to prevent parasitism. They should be stored at 45° F., if it is wished to prevent the emergence of the adult fly for a time. Otherwise they are enclosed in small screen cages which are cone topped, the small opening at the top being closed by a cork. On emergence the flies congregate in the cone. They can thence be easily released into the pollination cage as desired. Wire screen appears to be the best material for these pollination cages.

244. FELLERS, C. R., AND OTHERS. 635.3 : 577.16

Effect of fertilization, freezing, cooking and canning on the vitamin C and A content of asparagus.

Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 145-51, bibl. 13.

Tests on the 1932 and 1933 crops showed no significant differences in vitamin C or A content resulting from varying the amount of potash or nitrogen in the fertilizers applied. Freezing was not found to affect the vitamin C content. Canning caused a loss of 75% vitamin C while cooking caused a loss of 70%. Vitamin A was apparently not affected by cooking.

245. BREMER, A. H. 635.34

Chinesischer Kohl oder Selleriekohl (*Brassica pekinensis* Rubr.) eine Langtagspflanze. (Chinese cabbage(?) a long day plant.)

Gartenbauwiss., 1935, 9 : 325-30.

This plant subjected to ordinary daylight conditions in Norway, i.e. about 18 hours at the end of June, runs quickly to seed. If its light is restricted to 11½ to 12 hours by means of sacking, it will be found to form leaves instead of flowers. It can then be used when young for salads and later as a cooked vegetable. Its growth is rapid and therefore suited to northern climates and its taste is said to be excellent.

246. SHUCK, A. L. 635.52 : 612.014.44

Light as a factor influencing the dormancy of lettuce seeds.

Plant Physiol., 1935, 10 : 193-6.

Lettuce seeds are continually changing organisms which show different degrees of dormancy depending on their age or physiological condition. The seeds often exist in a dormant condition in which certain of the life processes necessary for germination appear to be in a state of delicate equilibrium. This condition can be broken by exposing moist seeds to light. By drying the seeds in daylight or exposing them to the shorter wave lengths of the spectrum a similar condition can be re-induced. The presence of water in the form of a film surrounding the seed is not necessary. The transformations are due to the light causing certain photochemical changes in the seed.

247. BOLAS, B. D., AND MELVILLE, R. 635.64-1.829

The effect on the tomato plant of carbon dioxide produced by combustion.

Ann. appl. Biol., 1935, 22 : 1-15, bibl. 6.

The effect of carbon dioxide on tomato plants growing in a small greenhouse has been studied, the gas being produced by burning paraffin in a pressure burner. An increased yield of fruit of 23·9% for the first half of the season and 13·9% for the whole season was obtained. A significant increase in the growth rate of tomato seedlings was induced. The distribution of carbon dioxide in the glasshouse was investigated and the sources of loss examined. [From authors' summary.] As regards the economic aspect, the experiment was carried out in a chamber 14 ft. × 14 ft. × 7 ft. sides (11 ft. at roof-ridge). Four "Primus" burners were used and were supplied with paraffin at a pressure of about 2 kg. per sq. cm. from a single pressure vessel. The generator was used

on 86 days during the season (gas being withheld only on very dull days) and a total of 92.5 gal. paraffin was burnt at a cost of £5 2s. The extra crop realized did not cover this amount. It is, however, pointed out that in a larger greenhouse much of the loss of gas experienced should be avoidable. It is hoped, moreover, that investigations as to the conditions of light and temperature under which tomatoes can make the best use of carbon dioxide may facilitate further reductions in cost. A comparison of crops and prices suggests that CO₂ treatment is most likely to be economical early in the season when prices are still high.

248. CHAMBERLAIN, E. E. 635.64-2.8
Narrow-leaf—a virus disease of tomatoes.
N.Z. J. Agric., 1934, 49 : 257-63.

An account of a hitherto unrecorded disease of tomatoes in New Zealand. The chief symptoms are narrowing and curling of the leaves, with subsequent reduction of leaf area. The fruit fails to set and the yield is much reduced. The disease has been found in 50% of commercial gardens. Investigations are described which show that the condition is due to a virus of which the aphid *Myzus persicae* is a vector. Tobacco plants are also susceptible. The name "narrow-leaf" is suggested.

249. RAABE, A., AND SENGBUSCH, R. V. *fulvum*. 635.64-2.48
 Zur Physiologie von *Cladosporium fulvum*. (The physiology of *C. fulvum*.) *Gartenbauwiss.*, 1935, 9 : 182-8, bibl. 5.

The authors show how this fungus disease of tomatoes and other *Solanaceae* has been and can easily be confused with *Trichothecium roseum* Lk. and how it may be distinguished from it by culture experiments.

250. WALTON, C. L., AND OTHERS. 635.656-2.651.3
The effect of calcium cyanamide and of formalin on pea "sickness". (Progress report).
J. Bath. W.S. Co. Ass., 1934-5, 9 : 137-40, bibl. 6.

In trials at Berkeley School, Glos. and Ston Easton Park, Somerset, on ground heavily infested with eelworm, using single controls, plots treated with formalin and calcium cyanamide produced apparently healthy plants in marked contrast to those of the control plots. A slight reduction in the number of cysts of *Heterodera schachtii* was also apparent. The rate of application was : Calcium cyanamide 10 cwt. per acre, formalin (1 : 50 solution) 1 gallon per yard. The formalin treatment would obviously be uneconomic at this rate.

251. MULLER, A. S. 635.652-2.4
 Doenças do feijão em Minas Geraes. (Diseases of kidney beans in Minas Geraes) (Brazil).
Bol. Agric. Zotech. Vet. Minas Geraes, 1934, 7 : 383-8.

Six diseases commonly attack beans in the State of Minas Geraes, the most destructive being ascribed to the fungus *Colletotrichum lindemuthianum* (S & M) B & C. The disease originates usually on the leaves and passes thence to the stems and pods where it forms depressed canker-like lesions and prevents further development. Beans which have reached maturity and are so attacked cannot be used as seed since infection can be carried through to the succeeding generation. It is advisable to use immune varieties of which several exist. Rust (*Uromyces appendiculatus* (Pers) Lev.) attacks the leaves, where it forms a mass of pustules on both sides. The pods are rarely attacked. The disease appears mainly in seasons when the spring rains are below normal. Its effect is to atrophy the plant with a resulting diminished yield. Certain varieties show considerable resistance and these should be planted. Angular spot (*Isariopsis griseola* Sacc.). Small, shallow, angular, black spots appear on the leaves between the veins.

* See *Annu. Rep. Long Ashton Res. Sta. for 1933, 1934*, pp. 74-85, *H.A.*, 1934, 4 : 3 : 413.

The disease is only severe during prolonged dry weather. Beans cultivated under good conditions of soil and weather rarely suffer. Certain varieties possess considerable immunity. Mildew (*Oidium* sp.). This appears in seasons which are unduly wet or when there is much dew or mist. If the attack is strong, the foliage atrophies, withers and finally dries up. There appear to be no resistant varieties. Beans should be cultivated during the drier parts of the year. A mosaic disease causes yellowing and atrophy. It can be transmitted through the seed. Most varieties are susceptible, though one, Mantegeo, has never contracted the disease during 5 years' observation. Red rot caused by the fungus *Rhizoctonia Solani* is chiefly found on young plants. Long, reddish, cankerous lesions destroy the stems at soil level. The disease can be carried on the seed and spreads from plant to plant. It is most pronounced during the rains, and lowlying bean fields should not be planted in wet weather. There appear to be no immune varieties. Tables are given showing the comparative susceptibility of a number of varieties under local names.

252. TINCKER, M. A. H.

632.954

Popular weed killers.

J. roy. hort. Soc., 1935, 60 : 68-79, bibl. 19.

This article gives an account of the substances more commonly used in gardens as weed killers, noting their uses, probable results and disadvantages. Those dealt with are as follows : common salt, petrol and less volatile hydro-carbons such as paraffin, ammonium and ferrous sulphates, domestic disinfectants such as carbolic acid, etc., arsenical compounds, the chlorates of sodium and calcium and possibly magnesium, sulphuric acid, copper and iron sulphates, cyanamide, ammonium thiocyanate. The bibliography contains references to more particular information on the use of the different materials.

The following also are noted :—

REINHOLD, J. AND OTHER. Der Einfluss des Nährstoffgehaltes des Bodens auf den Gemüseertrag in Siedergarten. (**The effect of nutrient content of the soil on vegetable crops in small holdings.**) *Gartenbauwiss.*, 1935, 9 : 205-18.

MINISTRY OF AGRICULTURE. (**Leaf spot of celery.**) *Advis. Leaflet. Minist. Agric. Lond.*, 241, 1935, pp. 4.

MINISTRY OF AGRICULTURE. (**Spotted wilt of the tomato.**) *Advis. Leaflet. Minist. Agric. Lond.*, 238, 1935, pp. 4.

FLOWER GROWING.

253. GREEN, D. E.

635.937.34-2.3/4

Common diseases of the rose.

J. roy. hort. Soc., 1934, 59 : 470-6.

The author deals in turn with common rose diseases and gives practical hints as to their control. Rose mildew (*Sphaerotheca pannosa*). Remedy—repeated spraying of both surfaces of the leaf with 1 in 80 lime sulphur including a spreader of some sort. Black spot (*Diplocarpon Rosae*). Remedy—spraying up to say 6 times at fortnightly intervals with bordeaux (4-4-50) + spreader. Rose canker (*Coniothyrium* spp.). Remedy—cut out, cover wounds, keep bushes healthy by care of soil and environment. Rose rust (*Phragmidium mucronatum*). Remedy—remove dead infected leaves and keep bushes healthy. Crown gall (*Bacterium tumefaciens*). Remedy—if galls are found on roots burn plants and rest ground from roses for a couple of years. *Botrytis cinerea*. It is suggested that the removal of dead and dying wood and the use of better balanced (possibly less nitrogenous manures) would help to control this disease. Chlorosis. This yellowing of the foliage being physiological is due to faulty soil conditions which can often be remedied especially on chalky soils by the application of sulphate of iron say about 1 oz. to a plant spread and worked in round the plant or sprayed as a solution on the foliage (1 oz. to 6 gall. water). Proper drainage will also help. Other diseases touched on briefly are *Gnomonia Rubi*, *Peronospora sparsa* (or downy mildew) and silver leaf.

254. RICHARDSON, H. H. 635.944-2.73
Studies of derris, nicotine, paris green and other poisons in combination with molasses in the control of the gladiolus thrips.
J. agric. Res., 1934, 49: 359-73, bibl. 11.

Taeniothrips gladioli spends part of its time in the leaf sheaths beyond the reach of a contact spray and only part on the exposed foliage. Hence it is most important to maintain a toxic spray residue on the foliage. Pyrethrum owing to the instability of its residue appears to have value only as a contact poison and does not, therefore, remain long toxic to thrips. The other substances used, including hellebore in addition to those given in the title, when combined with molasses leave residues which will stay effective for varying times, the inorganic poisons being the most stable. Most of the residues are, however, easily washed off by rain, only the paris green residues of those exposed to rain retaining considerable toxicity after a 0.6 in. fall.

CITRUS AND SUB-TROPICALS.

255. UPHOF, J. C. T. 634.3:581.44/45
Wissenschaftliche Beobachtungen u. Versuche an Agrumen. VII. Die Morphologie der Dornen. (Notes and experiments on citrus varieties. VII. Thorn morphology.)
Gartenbauwiss., 1935, 9: 219-30.

The extremely varied ideas of older authorities, Rumphius, Urban and others, on the nature of thorns in citrus are discussed. The present writer, basing his opinion on his personal observations and examinations which are detailed here, comes to the conclusion that there is no evidence for the thorn being of a leaf nature, but that it is undoubtedly both morphologically and anatomically more in the nature of a stem. He gives a clear, illustrated description of thorns on a large number of varieties of orange, grapefruit, mandarin and lemon.

256. POPE, W. T. 634.3
Citrus culture in Hawaii.
Bull. Hawaii agric. Exp. Sta., 71, 1934, pp. 37, bibl. 30.

Coffee, sugar and a growing livestock industry together with the ravages of the Mediterranean fruit fly (*Ceratitis capitata*) since 1910 have been responsible for a much diminished citrus industry in Hawaii. Work on citrus has, however, been persistent since 1904 at the experiment station, where the citrus experimental orchard contains 238 trees representing 40 different species and varieties. The varieties available are listed and the more important described, most of the bulletin being devoted to notes on the cultural treatments generally accepted as best for Hawaiian conditions. Since 1906 seed propagation has been used mainly to develop rootstocks on which to graft desirable varieties. These have been grown from sweet, sour and trifoliate oranges, rough lemon, pomelo of the shaddock type and tabog (*Chaetospermum glutinosa*). The last has now been discarded as being of too slow growth. Trifoliate does not appear to offer any particular advantages, while rough lemon and sweet orange have been discarded owing to their lack of resistance to gummosis. Sour orange and shaddock have proved best, especially the latter owing to its great vigour, adaptability to grafting and apparent disease-resistant qualities. The Cleopatra mandarin is also under trial as a rootstock. The most successful method of propagation has been side bark grafting scions of the current year on to 10-month-old seedlings of shaddock or sour orange growing in 8 inch containers. It is found that attacks of gummosis will be rare using these stocks, provided they are planted rather high so that eventually the crown roots are slightly exposed above the general surface of the ground, and provided the soil is not allowed to become sour by waterlogging or otherwise. The use of cover crops, turned in once or twice in the year, is advocated. Those used at the experiment station include *Phaseolus Mungo*, *Crotalaria juncea*, *Vigna Catjang*, *Stizolobium aterrimum* and *S. Deeringianum*. The fruit fly can be fairly adequately controlled by counter parasites, but many growers find that all the danger of fruit being punctured by the fly can be obviated by bagging with brown paper or cellophane bags 4 or 5 weeks before maturity.

257. WEBBER, H. J. 634.334-1.541.11

Influence of rootstock strains on yield and size of lemon trees.

Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 83-8, bibl. 1.

The plan of the experiments was to grow plots of 5 trees of each variety of lemon on a particular stock and to repeat these plots twice or more in each place. They were laid down at Riverside and at Sespe with its very different environment. The first field plantings were made in 1927 and individual tree records of yield were kept from 1931 to 1933 inclusive. Trunk cross sections were also obtained in 1932 by measuring the circumference 6 inches above the bud union. The bud wood was all taken from individual trees and the stocks of different types were seedlings previously submitted to very careful examination at which all variants were discarded, leaving, it may be reasonably supposed, a genetically homogeneous progeny. The summarized data are tabulated. It will be noted that they are from trees only 7 years old and results should therefore be considered as suggestive rather than conclusive. Still in view of the facts that they do greatly favour trees on this stock and that many old lemon groves on sweet orange are known to be in a flourishing state, the author considers that the safest general advice at the present time probably is to work lemons—at least Lisbons and Eurekas—on sweet orange. Results on rough lemon have also been satisfactory, but in the absence of old plantings on this stock it is suggested that small experimental plantings should precede any commercial planting on this stock. It is also noted that of the sweet orange stocks, Bessie, Madam Vinous and a sweet seedling 1a4-24 resulted in better crops than other sweet varieties at both places and care is urged in selecting the correct sweet orange strain to give best results. According to the evidence given here of results on large numbers of different stocks, e.g. rough lemon, sweet orange, sour orange, mandarin, grapefruit, etc., and different strains thereof, certain strains of a species may apparently be expected to give better results than other strains of the same species when worked with a given strain of a particular scion variety.

258. HASKINS, C. P., AND MOORE, C. N. 634.3 : 537.531

Growth modifications in citrus seedlings grown from x-rayed seed.

Plant Physiol., 1935, 10 : 179-85.

The experiments were conducted with seeds of lemon, lime, tangerine, grapefruit, sweet and sour orange. Part of the seeds were x-rayed in dry condition as soon as received, another portion being first soaked in distilled water for 15 minutes and kept in a moisture saturated atmosphere for 12 hours, dried on filter paper and exposed at once. Seeds were sown in trays in a compost of $\frac{1}{3}$ peat moss and $\frac{2}{3}$ sharp sand and kept at a day temperature of 75° F. and a night temperature of 55° F. The more conspicuous variants were transplanted to a compost of sand, clay and manure when a few months old and maintained in the greenhouse for a full year. The source of the x-rays was a Coolidge water-cooled tungsten-target tube of the thick walled type operated at 200 K v.p. and 30 ma. from a high tension transformer equipped with a Snook mechanical rectifier. The seeds were exposed on a lead covered table at a focal distance of 50 cm. *Premature flowering.* Although the pH of the bed was maintained at a level which should discourage early flowering, of grapefruit seed which had had x-ray dosages of from 300-1,300 roentgens in both wet and dry states 10% came into flower simultaneously at nine months old, while two plants flowered within 6 weeks of germination. Of these one which had received 300 roentgens was normal in leaf and flower colouration but deficient in roots. It grew slowly. The other which received 1,300 roentgens was very deficient in chlorophyll and soon died. In both the flowers though small were normal. Other noticeable features were as follows: *Albinism*, which is never completely absent among batches of citrus seedlings, was present in varying degrees to a very much greater extent among the treated plants. *Fasciation* both of terminal and lateral buds was frequent in treated plants. *Twisting.* A marked twisting in a counter clockwise direction occurred in the case of two young seedlings but normal growth was resumed after six months. It is possible that the early condition was brought about by x-ray induced abnormal mitoses. *Duplication* occurred in many instances. The mid-ribs of leaves were nearly evenly split near the base, or the entire leaflet was duplicated, or leaves either partially or wholly bifoliate and trifoliate often co-existing on the same plant were produced.

A cup shaped peloric leaf occurred in 2 otherwise normal seedlings of grapefruit, the leaves proceeding laterally from the stem some distance below the terminal bud. They persisted for a year.

259. ABBOT, C. E. 634.3 : 581.145.1/2

Blossom bud differentiation in citrus trees.

Amer. J. Bot., 1935, **22** : 476-85, bibl. 3.

Collections of twigs were made at random from the spring, summer and autumn flushes of growth on grapefruit, orange and satsuma trees growing at Gainesville, Florida. The trees varied from 14 to 24 years in age. Until 1926 they had received clean cultivation + cover crop, but since then they have had no cultivation and they are now growing in a sod of Bermuda grass. Kumquat twigs were also taken from trees in the grounds of the experiment station at Gainesville. Differentiation was considered to have started when longitudinal sections of the bud showed a broadening of the growing point with concurrently developing lobes. Two years' observations showed that differentiation took place at the initiation of growth in the spring or on resumption of growth at any other season of the year following a period of environmental conditions favourable to and of sufficient duration for the accumulation of a reserve food supply. Thus, prolonged, moderately dry periods which cause an extended check in growth favour blossom bud formation when growth is resumed. There were indications that ringing followed by rapid healing of the wounds did not appreciably affect blossom bud differentiation, whereas ringing where wounds were prevented from rapid healing tended to increase the number of buds differentiated at the next flush of growth.

260. SINCLAIR, W. B., AND OTHERS. 634.31 : 581.192

The isolation and distribution of nitrogen in dilute alkali-soluble proteins of healthy Valencia and Washington Navel orange fruits.

J. agric. Res., 1935, **50** : 173-80, bibl. 14.

Investigations now in progress include a study of the effects of fumigation, sprays, storage and other factors on the nitrogenous constituents of citrus fruits. This paper deals with the isolation and distribution of nitrogen in the proteins of the solids in the edible part of healthy oranges. The scanty literature on the subject is reviewed after which detailed methods are described for the isolation and purification of the dilute alkali-soluble proteins of orange pulp. Conclusions thought to be warranted by the data obtained in experiments carried out in accordance with this technique are discussed.

261. OPPENHEIMER, H. R. 634.3-1.821

Problems of citrus nutrition.

Hadar, 1934, **7** : 268-71 and **8** : 14-7, bibl. 21.

Further work is necessary on the problem of liming Palestinian soils. All that can be suggested at present is that light soils, owing to loss of exchangeable bases by leaching of the soil colloids, may develop acidity and may, therefore, require an application of lime. In soils of normal structure and neutral or slightly alkaline reaction liming is probably unnecessary.

262. MORRIS, A. A. 634.3-1.4

A review of soil conditions and grove practices at the Premier Citrus Estate, Umtali.

Annu. Rep. Mazoe Citrus Exp. Sta. for 1933, being *Publ. British South Africa Company*, **3**, 1934, pp. 35-63, bibl. 3.

A survey originally undertaken to decide whether a change of the existing fertilizer formula might increase the yield of certain citrus groves, particularly of Valencia Late whose cropping was below normal, indicated that a modification of existing practices in grove management had at least as great a possibility of increasing yield as any change in the fertilizer programme. Suggestions were as follows. *Ploughing*. The disk harrow should take the place of the plough in view of the fact that the trees are shallow rooted and that the heavy nature of the soil renders

ploughing possible only at certain times which may not be convenient. *Irrigation.* Water should be given only when the characteristic appearance of the tree at wilting point indicates the need. The application of water at fixed intervals irrespective of the condition of tree or soil is condemned. It should be made certain that water penetrates into the undisturbed area under the drip of the tree. The slow lateral penetration of water in clay soil may be responsible for the tendency to delayed blossoming which is most strongly marked in heavy soils. *Trench-drainage.* The need of deep trench-drainage in lowlying areas is pointed out. *Short irrigation leads.* Eleven trees per lead is considered a maximum for the heavier soil areas. *Wind-breaks.* The eucalyptus trees planted as wind-breaks on this estate are now 100 feet high with a correspondingly wide-spread rooting system. The result is an impoverished soil and a hindering of frost drainage. In a recent frost the unprotected areas suffered much less than those enclosed on all sides by tall trees. It is recommended that most of the wind-breaks should be eliminated. Cover crops should be planted and turned in as early as possible. The reasons for this are given in the report for 1933 by the author (*H.A.*, 1933, 3 : 4 : 534). *Method of planting.* A fair proportion of coarse sand should be incorporated in the soil of the plant holes. This has been found to give much improved rooting on heavy soils. An admixture of 2 lb. of rock phosphate per tree is also recommended for those soils where the penetrative power of phosphoric oxide is low. The holes should be deepened beyond the immediate requirements of the young trees. *Fertilizers.* After a discussion of the manurial system used on the Estate where the soils are mainly of the clay-loam to clay class it is recommended that the following formula should in future be used:—10·6 : 6 : 5·5 N.P.K. mixture at the rate of 10 lb. per mature tree of 10 years and over, applied just before the first irrigation after picking. Younger trees receive a proportionate amount. The manure should be applied to a limited area under and outside the tree spread and worked in by disc harrow or hand cultivation. Kraal manure at the rate of 150-200 lb. per tree should, if possible, be applied a little in advance of fertilizer application and disced in at once.

263. BABCOCK, W. G.
Economic program for maintaining adequate nitrogen for citrus.
Calif. Citrogr., 1935, 20 : 212, 218-20.

634.3-1.84

The article deals with the problem of maintaining a proper nitrogen supply in the semi-arid regions of the Pacific south-west with special reference to citrus culture. Differences bearing on fertilizing principles between humid regions and semi-arid regions are described. In the former there is a loss through leaching of the more soluble elements of the soil and the soil usually has more humus and an acid reaction. With rainfall or overhead irrigation the movement of soil moisture is principally downward, so that soluble material is carried direct to the feeding roots below. With furrow irrigation and fertilizers applied in solid form it is suggested that such dissolved materials as pass through the soil must tend to concentrate at a point approximately half-way between the furrows in the area above the furrow bottoms with a reduced but more even distribution in the area below the furrow bottoms. Little fertilizer incorporated in the top soil will reach the roots lying below the level of the furrow bottoms by means of irrigating water, and it will not be till the winter rains that such portion as has become soluble will be carried downwards to the roots. The danger then arises that there may be excessive loss of nitrogen through heavy leaching to below the area of the roots. Far better results can be obtained by applying nitrate fertilizers to the irrigation water, in which form it will be carried to all parts that the water reaches in a form readily available to the tree.

264. MCGEORGE, W. T.
Some aspects of citrus decline in Arizona.
Calif. Citrogr., 1935, 20 : 198, 214-6.

634.3-2.19

It is shown that citrus decline in Arizona is a physiological disturbance probably of a nutritional character and that some of these disturbances may be caused by abnormal mineral food absorption which characterizes the growth of most crops on alkali soils. Two means of aiding the crop

on these soils are possible :—(1) by adjusting the composition of the irrigation water, (2) by the application of certain corrective amendments to the soil. The application of small quantities of acid to reduce the pH of the irrigation water, which owing to the change through evaporation of the bicarbonates to carbonates may rise to 8·5 in summer, is considered feasible. Sulphuric acid is a local by-product which could be cheaply obtained. Air passed over an electric arc and thence into the irrigation stream would materially reduce the pH and at the same time add large quantities of nitrates to the water. The corrosive effects of acid on concrete are mentioned, but the arc process is unlikely to produce sufficient acid in moving water to cause injury. For treatment of alkali soils the use of organic manures combined with sulphur is advised. The organic manure works for better fertility because of the generation of carbonic acid which follows its incorporation in the soil, while the sulphur is active because of its oxidation to sulphuric acid. These practices are designed to reduce the pH of the soil solution to the optimum point for food absorption by the roots so that their time and energy may not be expended in reducing the pH of the soil solution to the point where food absorption may proceed. As a proof of the handicap under which citrus roots work in soils of high pH it is stated that in Arizona soils citrus roots rarely if ever produce root hairs, whereas under optimum conditions and in their native habitat root hairs are developed.

265. ROBSON, G.

634.3-1.547.6

Citrus maturity tests.*Food Manuf.*, 1935, 10 : 162.

Palatability in oranges is largely conditioned by the balance between sugar and acid contents. Maturity tests designed to prevent the export of immature fruit and to preserve uniformity are operative in most countries. In California the 8 : 1 test requires that the juice shall contain soluble solids equal to or in excess of 8 parts to every part of acid calculated as anhydrous citric acid. If the colour is at least 70% at time of picking, a minimum ratio of 6 : 1 is allowable. Fruit may not be artificially coloured unless the ratio is at least 8 : 1. In South Africa the minimum ratios must be at least 6·5 : 1 for Washington Navels, 6·0 : 1 for Valencias and 5·5 : 1 for seedlings. Although these ratios are lower than the Californian standards, there are in addition a number of amendments to prevent the export of sour and insipid fruit. A minimum juice content is required and a minimum weight per packed box according to the count, while there is a careful inspection for wastage at the port of shipment. In Australia the test is based on acid content, only the minimum standards being intermediate between those of California and South Africa. There is reason to believe that this test is a more accurate index of quality than a soluble solids : acid ratio, and it is in addition simple to apply in practice.

266. HAAS, A. R. C.

634.31-1.8 : 581.192

Juice of navel oranges in relation to soil fertilization.*Calif. Citrogr.*, 1935, 20 : 160, 172-3, bibl. 9.

Studies were made of the effect of various fertilizers on the inorganic composition of the juice of navel orange fruits from the Rubidoux manurial trial plots at Riverside Experiment Station, California. The trees are presumably mainly on sweet orange stock, though certain groups on trifoliolate and sour orange were included in one plot and tested separately. Though the juice of fruits from the plots receiving no nitrogen contained less nitrogen than that of fruit that had received nitrogen, the differences were not considered significant. Potassium and phosphorus applications were not reflected in the fruit juices. Juice from the potassium chloride plot contained a larger amount of total chlorine than that from all except the superphosphate plot (both on sweet stock). The juice from fruit on trifoliolate stock on the manure and cover crop plot, however, contained a greater amount of chlorine than any, which may be accounted for by the trifoliolate stock having depleted the soil moisture to a greater extent than the other stocks with a resulting concentration of fruit juice as shown by the amount of ash. Other salts were also more abundant in the juice from the trifoliolate plot. The calcium content of the pulp juices was in most cases less than the magnesium content. Approximately half the ash of navel orange juice is potassium while sodium is present in relatively small amounts. Juice from the

nitrate of soda plot showed the highest inorganic phosphorus content and the second highest calcium content. It is pointed out that conclusions based on pulp juice analyses assume that soil moisture is uniform throughout the grove, which is not the case.

267. DAVIS, W. B. 634.3-2.111
Detection and measurement of freezing injury in Valencia oranges.
Amer. J. Bot., 1935, 22: 559-66, bibl. 7.

The hesperidin crystal and desiccation tests of freezing injury, though used by the State of California, are not entirely satisfactory. We are here given an account of the first steps in an attempt to find a better method. Valencia and Navel oranges were frozen in the laboratory and the freezing injury was then measured by determining the resistance to the passage of an electric current through the living tissue. The resistance in different parts of the same orange varied owing to unequal injury and accordingly an expression of this variation, the coefficient of variation, was calculated for individual oranges. The method appears to afford a good measurement of injury, but there is considerable room for improvement in the time taken by the operation of testing, which at present is much too long, and also it will probably need considerable adaptation before being successfully applied to oranges frozen on the tree.

268. PARKER, E. R. 634.3-2.19
Experiments on the treatment of mottle-leaf of citrus trees.
Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31: 98-107, bibl. 15.

After the discovery that the effect of ferrous sulphate on mottle leaf varied and that the more effective ferrous sulphate contained an appreciable amount of zinc impurity, attention was transferred to the effect of zinc sulphate as soil applications, in the form of injections, and as sprays or dusts. It would appear from work to date that the application of zinc sulphate alone to the soil round citrus trees is unsatisfactory, at least using any form of technique devised so far, as either the effect is not great or more often injury to the trees results. The injection method has also not been entirely satisfactory. [Exact details are not given. The remark applies both to crystals and solution. The author notes the fact of injury and briefly states that these methods "seem not to be commercially feasible with citrus trees".—Ed.] All experiments point, however, to the successful use of the chemical in spray form, either alone or in combination. (See *idem.*, *Calif. Citrogr.*, 1935, 20: 90, *H.A.*, 1935, 5: 1: 95.) Summaries of certain results at Riverside, California, show that in all trials with oranges improvement has followed the use of a zinc sulphate-hydrated lime-water formula (10:5:100), the application being spread over several months. The effect on lemons has, however, been more variable, some lemons responding well, others very slowly to treatment. Very small amounts of zinc have produced remarkable recoveries. Thus zinc sulphate-lime mixtures as weak as $2\frac{1}{2}$: $1\frac{1}{4}$:100 have in some trials been as effective as a 20:10:100 mixture. Actually the equivalent of less than 1 gram metallic zinc has been sufficient to cause recovery of mottled trees 15 to 20 years old.

269. BRITON-JONES, H. R., AND BAKER, R. E. D. 634.323-2.4
Control of grapefruit diseases by cultural methods in Trinidad.
Trop. Agriculture, 1935, 12: 119-25, bibl. 8.

It is assumed for the purposes of this article that all commercial grapefruit plantations are on sour orange stock. Pending further evidence, the authors consider this to be the most successful stock at present in Trinidad while admitting that they have seen young grapefruit plantations on rough lemon that were consistently better in growth than those on sour orange. It is thought that this advantage is lost in later years. Heavy lands are to be preferred to light in spite of the objection that gummosis and other maladies are more rife on the former. It is claimed that, if the methods advocated here are followed, these objections will largely be rendered groundless. *Damping off*. This in Trinidad is probably due to fungi of the genus *Phytophthora*, though other organisms may be involved as in other parts of the world. The disease takes the form of water-soaked lesions on the stems near the ground which rapidly girdle and kill the seedling. *Scab*. *Sporotrichum Citri* Butler, as affecting sour orange seedlings, forms light brown warts or

scabs from 1 to 5 mm. in diameter on both sides of the leaves and on the stem. The leaves become distorted and wrinkled and growth is arrested. The growing point is frequently killed with the result that the lower axillary buds start into growth and a bushy plant unsuitable for stock work is produced. There is also an increased susceptibility to scale insect attack and the combination of the two frequently kills the plant. The disease is prevalent during the wet season and clean growth is often produced as soon as the rains cease. *Gummosis* attacks older budded trees chiefly on the susceptible grapefruit scion, just above the bud union, the sour orange stock being highly resistant. Drops of gum are exuded, but this is not sufficient for diagnosis as other factors may also be responsible for exudation. A correct diagnosis may be made by observing the dark brown stain which is left on the wood after patches of dead bark have been removed. The disease in Trinidad is caused by *Phytophthora parasitica* Dastur and *P. palmivora* Butler. *Root rot*, for which no primary parasite has been discovered, is usually found on trees growing in situations subject to waterlogging. The leaves of affected trees suddenly turn bright yellow and drop while simultaneously a heavy crop of small fruit is set, having thick skins, coarse juiceless pulp and a distinct flavour of quinine. The tree dies much more quickly than in the case of gummosis. The roots will be seen to have died back from the distal ends to the collar of the tree. The root bark is water soaked, soft and dirty yellow in colour and turns black later. *Threadblight*. Due to the fungi *Corticium Stevensii* Burt and *Marasmius* sp. It is definitely correlated with wet conditions. *Septobasidium* (*pseudo-pedici-latum* Burt?), though it usually causes little damage, can under very wet conditions grow luxuriantly on all parts of the tree, causing defoliation and death of small branches. *Pink disease*. The disease which derives its name from the light pink mycelium and spores of the fungus *Corticium salmonicolor* Berk. & Broome is rare but can cause considerable damage through the defoliation and death of affected branches. Recommendations are made with regard to seed and seedlings as follows:—Rigid seed selection is unnecessary. Important points are to use seed only from fully ripe fruit; to float off in water and discard undeveloped seed; to sow seed fresh before it dries out. Seedlings from dry hard seed often develop bench or twisted roots. Damping off and other troubles in seedlings can be prevented by sowing the seed in finely chopped coconut fibre which has been well dried and then soaked in Cheshunt mixture (2 oz. powdered copper sulphate, 11 oz. ammonium carbonate, mixed and stored in sealed glass vessels for 24 hours before use: to use add 1 oz. to 2 gallons of water). Give a further watering with the solution every 3-5 days. Scab can be prevented by keeping the seedlings away from direct sunlight. Directions are given for growing orange seedlings economically under the shade of cacao seedlings and for transplanting to nursery beds. Budding at a height of 18 inches is necessary to avoid gummosis: higher than 2 feet is unnecessary. Scion growth should be made to branch at 4 ft. from the ground. Gummosis and root rot is induced by trees with lower branches which when weighed down with fruit shade the crown: the amount and quality of fruit on such branches is, moreover, seriously affected. A method of building the framework of the young tree is described. A drainage system should be established in new plantations before the trees are put out. Planting should be in rows 25-30 feet apart, the trees being 18 feet in the rows. If growth is rapid, alternate trees are ring barked by strong wire at the end of the first year after planting and a month before the general flowering period. After flowering the wire is removed. In the following seasons these ring barked trees will produce a smaller, more regular and thinner-skinned fruit. The unringed trees will continue to grow and finally become dominant. The ringed trees can then be cut out. An annual cleaning up of the trees combined with a spraying against scale, moss and fungi should take place immediately after harvest. Manures, the composition of which will depend on various factors such as soil, previous cropping and rainfall, can be applied at this time.

270. TISDALE, W. H.

634.3-2.951/952

New combined spray for citrus trees contains ethyl mercury oleate in oil.*Citrus Ind.*, 1935, 16: 3: 8.

In Florida the problem of control of citrus pests and diseases is complicated by the fact that much of the scale is parasitized by "friendly" fungi which also succumb to the action of sprays.

With copper fungicides the sprays remain on the trees for a long time and prevent the regrowth of these fungi. Since in ordinary seasons scale and melanose infections are more or less periodic, sprays which remain long on the trees are unnecessary with properly timed applications. A very satisfactory, combined fungicide and insecticide appears to be an emulsion of carefully selected oils to which is added 0.51% of ethyl mercury oleate. For use this is diluted 1 : 60 with sulphur free water, sulphur reacting with the mercury to render it ineffective. Fruit fall due to stem end fungus infections has been markedly reduced by this spray. For scab control an application just before growth begins in spring is necessary, and for melanose this and two further sprays following petal fall are required. The optimum time of application and the number needed under different seasonal conditions is still uncertain. The ethyl mercury oleate is slowly dissipated and allows time for the friendly fungi to become re-established on the scale. Trees sprayed with this emulsion suffer very little from oil injury and there appears to have been considerable stimulation of twig and leaf growth and in general vigour together with a better set of fruit compared to unsprayed or differently treated trees. The spray has been in commercial use for two years with encouraging results.

271. SMIT, B., AND BISHOP, H. J. 632.752 : 634.3
A study of the citrus mealybug and its association with ants in the Eastern Province.

Bull. Dep. Agric. S. Afr. 125, 1934, pp. 41, bibl. 11.

The life history of the mealy bug, *Pseudococcus citri* Risso and others, which infests citrus in South Africa is described. Control by spraying is difficult owing to the protection afforded by the waxy covering of the insect, while in the case of fumigation with hydrocyanic acid gas it will support greater concentration than will the citrus tree. Biological control by the ladybird beetle, *Cryptolaemus montrouzieri*, of which very large numbers have been liberated, is vitiated through the action of the countless numbers of ants which infest the trees in search of the honeydew exuded by the mealy bug. They disturb the ladybird in its attacks on the mealy bug and also prevent it from egg laying. It is thought that if the ants could be kept from the trees the chances of the control of the mealy bug would be very much greater. Attempts to deal with the ants have been made as follows:—(1) Poisoning. (2) Banding the trees with sticky and hairy substances. (3) Banding the trees with repellent chemicals to repel the ants through action on their olfactory organs. A mixture known as United States Government Argentine Ant Poison was the most effective of the poisons tried. It consists of sugar 12 lb., crystallized tartaric acid $\frac{1}{4}$ oz., benzoate of soda $\frac{1}{4}$ oz., water 10 pints and honey 2 lbs., mixed with arsenite of soda $\frac{3}{4}$ oz., water 1 pint, the whole being compounded according to directions given here. The poison was placed at the foot of the trees in jam tins with holes cut in the sides and their tops covered with waxed paper. Containers were also made of hollow reeds the upper end left open, the node at the lower end preventing the escape of the fluid. These reeds were set in the ground with the upper open end touching the tree trunk. The most effective bands were those made of tanglefoot painted on the trunks over a preliminary coating of paraffin wax and protected from the weather by means of a projecting hood made of Malthoid tar roofing, which was nailed to the trunk above the band. When the inside of these protectors only was coated with tanglefoot perfect ant control was obtained. In these cases the protector was fastened round a cotton wool band to prevent access at the junction of bark and protector. The tanglefoot was made up of 27 oz. powdered resin and 12 fluid oz. crude castor oil. The oil was heated to nearly boiling point and the resin then slowly stirred in.

272. BATES, G. R. 634.31-1.55
The loss of weight of oranges between grove and market.
Annu. Rep. Maroe Citrus Exp. Sta. for 1933, being Publ. British South Africa Company, 3, 1934, pp. 64-91, bibl. 18.

Oranges lose water fairly rapidly during the first 6 or 7 days after picking. The rate of loss subsequently slows down and remains steady over a long period. The rate of evaporation of individual oranges under similar conditions is not the same but remains constant for each orange

during the early stages. This is taken as an indication that the rate of evaporation is already determined when the fruit is picked. Factors influencing this determination are the internal temperature of the fruit at time of picking, the time of picking and the position on the tree. Irrigation and rainfall do not appear of importance in determining the rate of evaporation. Loss in transit is influenced by temperature, air movement and humidity inside the trucks, the first two being the most important. The daily loss of weight under South African railway conditions is 6 and 7 times as great as during the sea voyage, which is probably due to the difference in storage conditions. In the case of Valentia Late the shorter counts 200, 216 and 252 lose less than the long counts 288 and 324. Loose packing leads to increased loss. With Rhodesian oranges the loss in weight between the packing house and Capetown usually exceeds the 2 per cent. allowance contained in the South African Export Regulations.

273. DEL LUNGO, A. 633.689
 Una pianta acquatica dai frutti preziosi. (An aquatic plant with valuable fruits.)
Ital. Agric., 1935, 72 : 49-52.

The author utters a plea for the greater use of *Trapa natans* or water chestnut.* Analysis of air dried fruits shows them to have the following consistency :—water 12.10%, nitrogenous matter 12.47%, carbohydrates (starches and sugars) 69.79%, fats 0.88%, cellulose 2.2%, ash 2.56%, figures which compare very favourably especially as regards carbohydrates and nitrogen with chestnuts, potatoes and acorns. They are eaten raw or cooked in Northern Italy and other parts of Southern Europe, the taste being similar to that of chestnuts, though not so full, or alternatively form an excellent, easily digested cattle food. They are propagated in any pond or sheet of fairly stagnant water where the depth does not exceed 4 metres by introducing the seeds—kept always in water—during the winter. They will germinate when the water reaches a temperature of 18° C. (64.4° F.).

274. VAN ELDEN, H., AND PHILLIPS, E. P. 633.85
Tungnut growing.
Bull. Dep. Agric. Union S. Africa, 140, 1935, pp. 14, bibl. 8.

In 1933 a questionnaire was circulated to all persons in the Union who had made application for seed of the tungnut. Replies which were received from some 25% of those written to form the basis of the information given here. Production seems most suited to those parts where land values are low and the production of more perishable crops is out of the question. The most economical method of propagation would appear to be sowing direct into the nursery rows 15 in. apart in the rows, there being 3 feet between rows. Very great variation is found to exist among seedlings and the advisability of selection and subsequent propagation by budding is stressed. Budding is found at the Nelspruit Station to be more easily done on seedling trees during their first season than when the trees are older, owing to the bark thickening with age. Seedling trees raised from seed planted in late winter are ready to bud in late summer. Best results in S. Africa have been got on deep sandy loam soils where slight frosts are experienced and there is an average rainfall of 30 in. The planting distance suggested is 25 ft. × 25 ft. Cover cropping is useful, sunhemp in particular being recommended for growing and ploughing in. The only pruning necessary is initially for tree shaping and later for removal of dead wood. The quality of oil extracted from trees grown in S. Africa is satisfactory according to British standards.† Attempts have been made to use the residue after oil extraction as a cattle food. Unfortunately, it contains an irritant of the digestive system, hence its obvious use is as a humus providing fertilizer in the soil. Pests and diseases have not as yet become serious in South Africa.

* Also called jesuit's nut and water caltrops (Bailey, L. H.).

† See *H.A.*, 1932, 2 : 4 : 395.

275. LEGROS, J.

633.85

Cultivation of *Aleurites* wood-oil trees.*Int. Rev. Sci. Pract. Agric.*, 1935, 26 : T.129-160, T.183-97, T.237-51, bibl. 63.

Short notes are given on the following *Aleurites* species : *Fordii*, *montana*, *cordata*, *moluccana*, *trisperma*. The two first are the most important producers of "tung oil". Summing up the climatic requirements of these two species the author notes that their needs are : plenty of rain in the growing season, a dormant period, absence of frost. The general principles on which their cultivation should be based are next discussed, after which points are noted peculiar to their growth in different parts of the world where they are successfully grown. Tung oil trees are cultivated in Japan, China, many British and French colonies, South Africa, Australia, New Zealand, the Belgian and Dutch Colonies, U.S.A., Brazil, Argentine and Southern U.S.S.R. From a review of their performance in these lands the author concludes that *A. Fordii* is emphatically a sub-tropical rather than a tropical tree. *A. cordata* and *A. montana* can also be cultivated in the sub-tropics. *A. moluccana* and *A. trisperma* need tropical conditions. The oils from the 4 first species are then considered, tung oil proper being derived only from *A. Fordii*, abasin, bancoulir and Japanese tung oil being the products of *montana*, *moluccana* and *cordata* respectively. The compositions, specifications and standards applicable to these oils in different parts of the world are separately detailed. Utilization of the by-products is discussed. Finally, world trade is touched on. The author does not consider that over-production in the near future is likely.

276. TISSOT, P.

633.95

La culture du camphrier et la production du camphre. (The cultivation of the camphor tree and the production of camphor.)*Rev. Bot. appl.*, 1935, 11 : 340-50, bibl. 26.

Camphor is used in medicine and as a household disinfectant, but nowadays 70% to 80% of the production goes in the manufacture of celluloid. The oldest known source was the *Dryobalanops camphora*, a native of Borneo and Sumatra, but the present source of true camphor is largely *Cinnamomum Camphora*, a species containing many varieties showing great variation in their chemical composition and extraction possibilities. China and Japan possessed and Japan alone now possesses a monopoly in true camphor production. *C. Camphora* is ordinarily a tree of 15 to 20 m. high, its original habitat stretching from the north of Indochina to the coast regions of China, situated below latitude 34° N. and to those parts of Japan which lie between Formosa and latitude 36° N. From there it has spread to other sub-tropical countries. It seems to grow well between latitudes 10° and 45° up to altitudes of 1,500 to 2,000 metres provided the temperature does not fall below about 43° F. Camphor is extracted by distillation of the wood which is got by felling the trees when at least 50 years old, their maximum return being probably when about 100 years old. An average production of raw camphor will be about 3% in weight. A large number of useful by-products can be further refined from it. Its cultivation presents no particular difficulty. The seeds are freed from pulp and soaked for 24 to 48 hours. They are then sown 3 together in holes 45 cm. from one another with 1 m. 15 cm. between the rows. A normal germination will be about 50 to 60%. In the first year only one plant is left per hole and this should reach a height of 30 to 45 cm. Transplanting takes place when they are 60 to 90 cm. high at about 2 to 3 years old. Planting distance will vary, the Japanese planting about 700 to 800 trees to a hectare,* while recent work in the Caucasus indicates the desirability of planting 625 per ha. if exploitation of the leaves is the aim or 275 if the purpose is afforestation. In view of the remarkably slow return ordinarily obtained attempts have been made to extract camphor from the leaves. This has been found possible, but long trials in Florida and elsewhere have proved it uneconomic, competition with wood and with synthetic camphor being too great. Other camphor producing plants are *Blumea balsamifera*, *Ocymum canum* and *Meriandra benghalensis*, but the camphor thus produced is not important. Actually the one important rival to natural camphor from *C. Camphora* is synthetic camphor

* Very roughly 280 to 320 per acre.

extracted from terebinthine, itself a forest product from pines. Synthetic camphor, unlike the natural product, is either inactive under polarized light or slightly laevorotatory according to the terebinthine used. It can only be used for celluloid manufacture and then after being freed from all traces of chlorine. Present demands for both kinds of camphor would appear to be satisfied, but it is urged that *C. Camphora* should be planted in the sub-tropics by forestry authorities, to form a store of capital for future needs.

277. JENKINS, A. E. 632.482 : 634.653
***Sphaceloma Perseae*, the cause of avocado scab.**
J. agric. Res., 1934, 49 : 859-69, bibl. 19.

The author shows how this fungus may be differentiated from *S. Fawcettii* with which it has in the past been confused. A full account of cultural studies in the laboratory is accompanied by photographs of the different stages of the fungus in culture. The present geographic range of the disease is discussed. It would appear not to be known in California (1933), Hawaiian Islands (1931), Rhodesia (1934), but in Florida several commercial varieties are found to be very susceptible to it. Control methods are not discussed.

278. MARCÜS, A. 635.23
Tapioca, *Manihot utilissima* Pohl. (Cassava).
Tropenpflanzer, 1935, 38 : 144-57, bibl. 11.

Brazil is probably the original habitat of *M. utilissima* which is a member of the *Euphorbiaceae*. Until recently distinction was made between so-called "sweet" varieties which contained large amounts of HCN and "sour" varieties, which did not contain so much. Since the discovery that this distinction depends on environment it has been customary to differentiate them initially into two groups according to the brightness of green of the ripe stem, and further according to the colour of stalks and leaves. Notes on cultivation are given. In Reunion Island the plant forms part of the following rotation: sugarcane (twice or three times), cassava leguminous crop. In the Philippines it alternates with groundnut. Cultural methods and the extraction process as leading to the various tapioca products of commerce are described. [A good deal of the information given is taken from Greenstreet and Lambourne's *Bulletin S.S. and F.M.S. Dep. Agric.*, general series No. 13, 1933 (*H.A.*, 1933, 3 : 4 : 544), but other authorities are also freely quoted in this interesting compilation.—Ed.]

The following also are noted:—

- HALMA, F. F. Some phases in the water relation of citrus. *Proc. Amer. Soc. hort. Sci. for 1934*, 1935, 31 : 108-9.
HAAS, A. R. C. Relation between the chemical composition of citrus scale insects and their resistance to hydrocyanic acid fumigation. *J. agric. Res.*, 1934, 49 : 477-92, bibl. 21.
PITCAIRN, A. The agricultural resources of Cyprus. The effect of natural and other factors on development. *Cyprus agric. J.*, 1935, 30 : 6-13.
BLISS, C. I., AND OTHERS. Productivity of the camphor scale, *Pseudaonidia duplex* Ckll. The biology of its egg and crawler stages. *J. agric. Res.*, 1935, 50 : 243-66.
CRESSMAN, A. W., AND OTHERS. Biology of the camphor scale and a method for predicting the time of appearance of stages in the field. *J. agric. Res.*, 1935, 50 : 267-83, bibl. 8.

TROPICAL CROPS.

279. SHEPARD, C. Y. 63 : 331
Agricultural labour in Trinidad.
Trop. Agriculture, 1935, 12 : 3-9 (bibl. 23), 56-64 (bibl. 18), 84-8, 126-131 (bibl. 8).

An account of agricultural labour in Trinidad from 1492-1934.

280. PARSONS, T. H. 631.542
Pruning in the tropics.
Trop. Agriculturist, 1935, 84 : 3-12.

The objects and principles of pruning are first explained. These principles do not differ from those for temperate countries, but owing to the absence of a definite resting period and the evergreen condition of the plant pruning is really reduced to a judicious thinning, once the framework of the young tree has been built up. Directions are given for forming the framework of young fruit trees of various kinds grown in Ceylon.

281. DEPARTMENT OF AGRICULTURE, S.S. AND F.M.S. 631.874
Green manures.
Agric. Leaflet. Dep. Agric. S.S. and F.M.S., 7, 1934, pp. 5.

This leaflet contains practical notes on the propagation, spacing, size and value of the following types of leguminous plants suitable for green manuring: *Cassia occidentalis*, *Crotalaria anagyroides*, *C. usaramoensis*, *Gliricidia maculata*, *Leucaena glauca*, *Tephrosia candida*, *T. toxicaria* and *T. Vogelii*.

282. HECK, A. F. 631.432
A soil hygrometer for irrigated cane lands of Hawaii.
J. Amer. Soc. Agron., 1934, 24 : 274-8.

This instrument consists of a porous clay filter candle attached by a copper tube to a mercury manometer 50 cm. long. The candle and tube are filled with water boiled to remove dissolved gases. The candle is buried 1 ft. deep in the soil, at the base of a metal framework 3 ft. high, which supports the manometer. The "capillary pull" due to the surface tension of the film of water round the soil particles draws on the water in the porous pot with a force which is in inverse relation to the soil moisture. This pull is indicated by the manometer. The moisture percentage corresponding to various manometer readings is found by calibration with soils of known moisture contents. The capillary pull : moisture curve is fairly flat below 25 cm. Hg., but rises sharply when the pull exceeds about 25 cm. Hg., indicating a greatly increasing resistance to the intake of water by the plant. The author concludes that, for best growth, irrigation should be applied whenever the capillary pull (at 1 ft.) reaches 20 to 30 cm. Hg. He notes that, if the soil becomes very dry, the moisture film in the porous candle breaks, so that the instrument can only be used in moist soils. [A preliminary report has been published on similar work at East Malling. *Annu. Rep. East Malling Res. Sta. for 1933*, A17, pp. 86-91; *H.A.*, 4 : 2 : 175, and a further report is in the press, *J. Agric. Sci.*, 25. ABSTRACTOR.]
W.S.R.

283. EDEN, T., AND EVANS, D. I. 633.72-1.8
The effect of manurial treatment on the composition of the made tea.
Emp. J. exp. Agric., 1935, 3 : 115-8, bibl. 7.

A comparison is made of analytical determinations of the chemical composition of the made tea from differently manured plots. There were two series of samples taken, extending over a three-year pruning cycle. In the first series a comparison was made between tea receiving no nitrogen and tea receiving 40 lb. nitrogen per acre. In the second series the comparison was between equivalent quantities of nitrogen of the three different types. The methods of analysis are described. The results show that manuring with nitrogen made distinguishable though unimportant, differences in the soluble nitrogen, caffeine and ash, but that differences between extract- and tannin-contents were indistinguishable. There were no differences between samples manured with the different types of nitrogen.

284. EDEN, T. 633.72-1.542-1.83/84
Studies in the yield of tea. III. Field experiments with potash and nitrogen in relation to the pruning cycle.
Emp. J. exp. Agric., 1935, 3 : 105-14, bibl. 9.

The experiment described in this paper was carried out to discover (1) the relationship between quantity of nitrogen and yield, (2) the value of organic and inorganic sources of nitrogen, and (3) the effect of potash on crop response. There were six replications of nine manurial treatments, the experiment lasting three years, the length of a normal pruning cycle. The yields are given as dry weights in pounds per acre, and show that potash produced no significant effect on "flush", foliage-leaf, or wood growth, but that an increase in amount of nitrogen applied produced a corresponding increase in the yields. There was no indication that saturation effects had occurred up to the maximum application, 40lb. per acre of nitrogen. Nitrogen was applied in 3 forms, namely blood-meal, sulphate of ammonia, and cyanamide, but there was no significant difference between results from these. Correlations between yields in successive years showed that differences between yields of parallel plots were not maintained when pruning intervened between the two years considered. Bush heterogeneity was more important than soil heterogeneity as a cause of variability. One of the experimental blocks was planted up with a different race, or jat, of tea, and this was characterized by a distinctive difference in yield distribution throughout the cycle. Analyses were carried out on samples to determine the composition of the crop, and to calculate the amount of nitrogen removed from the soil. The recovery of nitrogen was very low—about 18% only.

J.L.E.

285. MARSHALL, T. H. 633.73-1.541
Coffee grafting and budding.
Trop. Agriculturist, 1935, 84 : 93-6, reprinted from *The Planter*, 1934, vol. 3, no. 3.

The advantages of grafted and budded plants are pointed out. Apart from the benefits applying to grafted plants in general, which are too well known to reiterate here, rootstocks resistant to nematodes and borer attack are desirable in the case of coffee and are probably already in existence. The work from which the notes in this article were taken was carried on at the Morogoro Experiment Station which has a mean elevation of 1,700 feet above sea level and a mean annual rainfall of 33 inches with a long dry season, not ideal conditions for growing *arabica*. In the topworking trials the stocks were six-years-old *Coffea excelsa* which had never cropped. The scions were from a poorly grown *arabica*. *Bark grafting*. The stock is cut just above a node when the scion is ready for insertion. Internodal cuts result in dieback of the stock and consequent death of the graft. The scion of two to four buds is cut through below a bud, the length of the cut face being about 2 inches. An incision 2 inches long is made in the bark of the stock starting from the top, the bark is raised and the scion is inserted underneath it. The graft must be immediately tied and waxed, coffee being particularly sensitive to drying out. The graft is then covered to the top of the scion with a weatherproof bag or with banana leaves tied top and bottom. Union is comparatively slow, but once growth starts fruit is borne within a year. Grafts were most successful when both stock and scion were of approximately the same age and appearance, i.e. of half-ripened wood just turning from green to brown. *Side grafting*. The branch of the stock is cut just below the cambium to form a flat surface 2 inches long with a notch at the bottom of the cut. The scion is prepared as for bark grafting but with the bottom cut to fit the notch. The branch and scion should be of approximately the same thickness and the former need not be cut back until after union has been made. The remainder of the process is as for bark grafting. These two methods achieved 92% success. *Grafting under nursery conditions*. One-year-old seedling stocks of *C. buxobensis*, *C. liberica*, *C. Quillou* and *C. robusta* were successfully cleft grafted with *arabica* scions. Green wood from current growth was successfully used and the percentage of success was very high. *Budding*. This method can also be used with success, but the union of stock and scion is much weaker than with grafts and is liable to break off at the junction in heavy winds. The plants in this experiment were shield

budded. Buds inserted with lateral branches produce only lateral growth and have a tendency to produce multiple shoots from the base of the bud. Buds inserted into upright shoots will produce normal upright growth without a multiplicity of basal shoots. *General.* The work should always be done as quickly as possible, as on exposure to the air the cut surfaces of the coffee plant dry very rapidly. In topworking old trees only scions having a terminal growing point and grafted into an upright of the stock plant will produce growth other than lateral. This point is important in the grafting of seedling stocks or of trees heavily cut back, since scions without a terminal bud will produce only useless low growing plants.

286. NUTMAN, F. J. 633.73 : 581.144.2
The root system of *Coffea arabica*. III. The spatial distribution of the absorbing area of the root.

Emp. J. exp. Agric., 1934, 2 : 293-302, bibl. 2.

Parts I and II of this series described coffee root systems in various soils (*H.A.*, 1935, 5 : 1 : 125). In part III the author makes a pioneer attempt to measure the amount and distribution of the actual absorbing area of the root, including the root hairs. Samples of the root systems of four 3-year-old trees were obtained by washing out a prism of soil 1 ft. thick and 5 ft. deep, extending from 6 in. to 3 ft. 6 in. from the trunk in each case. The roots from each cubic foot of soil were preserved in formalin solution, and the number and length of feeding roots were determined by laying them in rows on lined paper. On occasion 150,000 rootlets totalling 580 m. were recorded in 1 cu. ft. The average diameter of feeding roots was found, by measurement of samples, to be 0.7 mm. Examination of sections less than 1 cell thick showed that 24% of the epidermal cells bore root hairs, and that the hairs were 11 times as long as they were wide. No statistical details of number or variation of these samples are given. Calculation from these figures shows that the total absorptive area is 9.26 times the superficial area of the feeder roots. From these data the author computes the total absorbing area of the whole root system. Roots in the 1 ft. diam. cylinder of soil below the trunk, and roots more than 5 ft. deep or more than 3 ft. 6 in. from the trunk are not considered. An eye estimate of the proportion of roots ignored is 20%. In the four trees mentioned the total length of feeding root per tree varied from 15.4 to 32.7 km., the average being 22.8 km. The average superficial area of feeding root was 50.1 sq. m. and of root hairs 426 sq. m. giving a total absorbing area of 464 sq. m. (i.e. 50.1×9.26). Figures are given for the amounts and concentrations of feeding roots in various soil regions. The concentration is fairly even throughout the recorded area. From 31% to 66% of the feeding roots were more than 2 ft. deep. Considerably more than two-thirds of the feeding roots were more than 1 ft. 6 in. away from the trunk. In view of the large absorbing surface of the root system, the author suggests that the limiting factor to rate of water intake is probably not the root hair under normal soil conditions, but may possibly be the rate of entry of water into the xylem vessels. The author acknowledges the obvious criticisms that a very small sample is taken as representative of the whole tree, and that the number of trees is small. As preliminary work in a difficult field this is a valuable and suggestive study. W.S.R.

287. WORSLEY, R. R. LE G. 633.88.51
Cinchona in Amani.

Bull. imp. Inst. Lond., 1935, 33 : 14-31, bibl. 6.

A short historical survey of cinchona in Amani is given. The alkaloid content of the various barks in different years is given, 10.55% quinine, expressed as sulphate, in Ledgerbark, and 11.21% in hybrid bark, being the highest obtained at any time. The yields of bark from the various species are given and results show that *C. Ledgeriana* produces considerably less than the others. The market value of the various barks is discussed and it is shown that the hybrid (*C. Ledgeriana* \times *C. succirubra*) commands the best price per tree, and *C. Ledgeriana* the lowest. In the case of the hybrid it is evident from the poor quinine content of trees raised from its own seed that it must be grown as a first cross between Ledger and *succirubra* to be of value. A description is given of the preparation and the composition of cinchona febrifuges. Notes on the soil and climate of Amani conclude the paper.

288. YERSIN, A., AND LAMBERT, A. 633.88.51
 Essais d'acclimation des arbres a quinquina en Indochine. (**Acclimatization of cinchona trees in Indo-China.**)
Rev. Bot. appl., 1935, 15 : 225-34.

The report, the fifth of a series, contains observations made since 1931. The weight of sulphate of quinine produced per tree increases regularly until the 8th year at least. The highest percentage of sulphate of quinine is obtained during the 4th year and thereafter there is a steady decrease. The trees are planted 1 m. apart spaced in rows 1 m. apart on one side and 2 m. on the other. In the 5th year this arrangement necessitates pruning the trees to some extent and thus provides a preliminary harvest of quinine. After the 6th year a systematic thinning out of the weakest trees is performed until at the 14th year they are standing about 4 × 3 m. apart. Manurial experiments showed most favourable results for the nitrate-phosphate plot (P 50 kg. per ha. (44.5 lb. per acre) in form of slag and N 36 kg. per ha. (32 lb. per acre) in form of sulphate of ammonia twice yearly). A disease of unknown origin but resembling a form of canker is prevalent particularly on the unmanured controls of the manurial plots. The quantity and quality of sulphate of quinine obtained from trees raised from the seed of the second generation of plants originally grown from imported Javanese seed has not deteriorated.

289. POLHAMUS, L. G., AND OTHERS. 633.913
 The rubber content of two species of *Cryptostegia* and of an interspecific hybrid in Florida.
Tech. Bull. U.S. Dep. Agric. 457, 1934, pp. 22, bibl. 9.

Investigations are here described on the growth and rubber content in Florida of *C. madagascariensis*, *C. grandiflora*, and a hybrid between the two. Before their introduction into America as ornamental plants both species had been used as a source of rubber in Madagascar and parts of India. The rubber content of the leaves of the hybrid has been found to be consistently higher than that of its parents, the maximum rubber content in any composite leaf sample being 5.97% in the hybrid. The rubber content was found to increase in direct proportion to leaf maturity, the maximum being attained when the leaves were about 3½ months old. Experimental data suggest also that the resins of fibre may be of value as by-products. The hybrid does not breed true. The most successful method of vegetative propagation has been box marcotting (air layering).

290. ARNDT, C. H. 634.441 : 581.141
 Notes on polyembryony and multiple shoots from the seed in *Mangifera indica*.
Amer. J. Bot., 1935, 22 : 26-30, bibl. 4.

The author's study of the development of the mango seed confirmed previous observations that polyembryony is quite common in the mango. He also found, however, that many of the germinating seeds growing beneath mango trees of the Coffee Experiment Station of Haiti showed multiple shoots, which were connected near the top of the hypocotyl and seemed to arise in the axils of the cotyledons. The cotyledons were inserted just below the junction of the three shoots. An examination of younger stages showed that multiple shoots were formed before or in the early stages of germination. Photographs are given showing this phenomenon and variations of it. His observations indicate that the multiple shoots which arise from the seed may originate through polyembryony, the development of adventitious buds on the seedlings before or during germination, or a combination of the two types.

291. CONROTTE, L. 634.6
 Technique générale d'une plantation de Palmiers *Elaeis* au Congo Belge.
 (**The planting and care of oil palms in the Belgian Congo.**)
Bull. agric. Congo belge, 1935, 26 : 46-87.

This is a very full account of the general principles adopted by the Société Huilèver in their plantations of oil palms (*Elaeis guineensis*) which are situated on and on either side of the equator.

The routine adopted from the very outset is detailed including the initial determination of soil suitability by sampling and analysis, both physical and chemical. In selecting seed, possibly from native trees, care is taken to select only from trees in which the pericarp forms at least 70-80% of the fruit. The preparation and care of seed beds are described. Plants are moved to the nursery when possessed of 1 to 3 leaves and there they stay for 1 or 2 years or until they have developed 9 to 12 leaves. Clearing the land for the plantation proper and its sowing with cover crops follow. Leguminous cover crops are recommended, those commonly used with success being *Calopogonium mucunoides* and *Pueraria javanica*. Operations after planting are discussed at some length and a table is given in which the average work in man days spent per hectare on cultural operations each year during the first 5 years are set out. They are as follows: weeding round the palms 9, general weeding 5, care of cover crops 2, road upkeep 3, pest and disease control 1, replacements 2. Notes are given on what the above work entails. A short section is devoted to control of pests and diseases: so far these have not become really serious.

292. PAINE, R. W. 634.61-2.69
Observations on rat damage to coconuts on Taveuni.
Agric. J. Fiji, 1934, 7: 26-34.

It is shown that rats damage the coconut crop in Fiji in at least four stages of its development—(1) before the spathe bursts; (2) after the spathe bursts, but before the fruit has set; (3) after the fruit has set, but before it is mature; (4) after harvesting during the drying and storage of copra. The damage is estimated for (1) and (2) at not more than 1% of the crop, for (3) at 30%, and for (4) at 5%. With copra at its present low price attempts at control may not be opportune. The only approved methods of control that appear practicable are trapping and poisoning.

293. PAGDEN, H. T., AND LEVER, R. J. A. W. 634.61-2.7
Insects of the coconut palm and the present position of the coconut problem in the British Solomon Islands Protectorate.
Brit. Solomon Is. agric. Gaz., 1935, 3: 1: 2-22, bibl. 14.

Two serious insect pests (beetles) of coconuts in the Solomon Islands and a number of minor pests are described with notes on their life histories and suggestions for their control when this appears feasible. The general condition of the coconut plantations in the islands is examined and the conclusion is reached that the cause of non-bearing or of immature nut fall is more probably due to unsuitable conditions of soil and rainfall than to insect attack.

294. ANON. 634.771 + 634.774
Malayan fruits. Pineapples, bananas and miscellaneous fruits.
Malay. agric. J., 1935, 23: 110-33, bibl. 17.

Pineapple and banana cultivation as practised in Malaya are dealt with in detail. Under the heading entitled Miscellaneous Fruits a brief description is given of various methods of vegetative propagation. This is followed by short notes on 35 varieties of the principal fruits grown in Malaya.

295. ANON. 634.771-1.8
La fumure du bananier. (Manuring of bananas.)
Rev. int. Prod. colon, 1935, no. 109, p. 9, from abst. in *Rev. Bot. appl.*, 1935, 15: 290.

Investigations by Teissonier in French Guinea have shown that the most successful manurial formula for bananas is 6% nitrate, 10% phosphoric acid, 11% potash, 8% lime. In addition to chemical manures stable manure or oil cake or some other form of humus forming material should be applied.

296. JACQUES-FÉLIX, H. 633.526.1
 Recherches de cultures annexes à la culture bananière pour la Guinée Française. Deux plants à fibres. (Crops to supplement banana culture in French Guinea. Two fibre plants.)
Rev. Bot. appl., 1935, 15 : 243-51, bibl. 8.

Abroma augusta L.f. (Sterculiaceae). A large leaved, much branched shrubby plant native of tropical Asia. The fibre is contained in the inner bark (liber) and is by some reputed to be superior to jute. The viability of the seed is of short duration and this applies equally to seed left on the growing plant after maturity; even fresh seed germinates poorly, but this can be improved by a preliminary soaking in water for 48 hours. Seed can be sown either in nurseries or on the site the plants are to occupy. Transplanting if done must be carried out in cloudy weather at the opening of the rainy season. Spacing should be 1 metre \times 60 cm. Harvesting is done during the flowering period and consists of cutting the plants down to ground level, an operation which they can undergo annually without harm for several years. Steeping is carried out in running water and lasts 12 days. The material is then picked out by hand and a series of washings and dryings produces a white fibre. The quantity of fibre obtained is 8.79% of the weight of the branches and amounts to 1814 kg. of saleable fibre per cut per hectare. Two or three cuttings a year can be made off the same stools. *Honckenya ficifolia* Wild. (Tiliaceae). This plant is a native of West Africa and succeeds clearings of *Raphia gracilis* in almost pure stands. The fibre which is obtained from the inner bark is fine and of good quality. Retting must not be prolonged or the fibre deteriorates. The harvest should be made at the time of flowering; if taken later than this it becomes brittle and breaks during combing. Older plants, however, can furnish material for papermaking. Its value on the market is about £1 per ton less than jute of similar quality.

297. SIMMONDS, J. H. 634.771-2.1/4 + 2.8
 Diseases of the banana.
Qd. agric. J., 1935, 43 : 254-67.

The various diseases attacking bananas in Queensland are described and illustrated. *Bunchy Top*. A virus disease of which the vector is the banana aphid. The leaves formed after infection are short and narrow with up-curved margins and leaf stalk greatly reduced in length giving a characteristic rosetted appearance. The foliage becomes crisp and brittle and fruit is rarely produced unless infection has taken place later in the life of the plant. A sure diagnosis can be made by examining the base of the youngest leaf with the light behind it. Infected plants will then show a series of narrow dark green lines, broken or continuous, lying between the veins. Often there are one or more wide, dark green streaks running down the outside of the leaf stalk near its junction with the pseudo-stem. The virus will spread throughout the parent plant and into the stools and suckers. Control at present consists only in the destruction of diseased plants and in making sure that planting material is obtained from uninfected sources. Early recognition is an essential factor in preventing the spread of the disease. To prevent the spread of aphids from an infected stool pour half a pint of paraffin into the central leaf of the affected plant and other plants connected with it in the same stool. After a few hours all aphids present should be dead and the infected stool can be dug up and cut into small pieces to facilitate drying. *Heart Rot*. A virus disease the most general symptom of which is a chlorotic condition of the younger leaves formed by light green or yellow streaks or bands which extend out from the midrib. In cold weather a soft black rot may develop in the funnel leaf, but with warmer conditions it may cease to extend. The young leaves growing out, however, may be narrow and irregular with signs of rotting at their margins. The disease does not spread as much as bunchy top. Control measures are the same. The vector is again the banana aphid. *Leaf Spot and Speckle*. These are probably two distinct fungoid diseases. Both are widely distributed throughout banana growing countries. The former is caused by the fungus *Cercospora Musae* and is manifested usually on the upper surface of the leaf in the form of narrow, oblong, brown to black areas measuring about $\frac{1}{2} \times \frac{1}{4}$ inches. The centre eventually dries out leaving a characteristic black bordered, grey spot surrounded

by a yellow halo. Speckle appears on the underside of the leaf in the form of scattered or aggregated dark brown to black blotches of varying size or intensity. The patches are formed by a close speckling of greyish dots which later darken and coalesce. The causal fungus is unknown. In both diseases the lower leaves are attacked first and in severe cases the leaf will dry out. Usually an equilibrium is obtained, whereby the plant maintains 3 unaffected leaves and 4 or 5 diseased ones showing infection in increasing intensity from upper to lower leaves. The growth of the plant or the initial size of the bunch is not affected, but since no more leaves are formed once the bunch is out, and the remaining leaves gradually become affected and die, the bunch is deprived of shelter and may fail to develop properly or may become scalded. Control by spraying or dusting is not very effective. The half of a corn sack thrown over the exposed side of the bunch and secured with a nail as soon as the fruit begins to fill provides a quick and fairly effective method of protecting it from the effects of defoliation.

Yellow Leaf Spot is apparently caused by the fungus *Cordana Musae*. Light-yellow areas of an elliptic or characteristic diamond shape develop on the lower leaves. They increase in size until about 3 or 4 inches long by $1\frac{1}{2}$ inches broad, when they gradually darken and dry out, leaving a narrow and distinct yellow margin. The fructifications form a greyish down covering the under surface of the spots. The disease is widespread but not troublesome except in Queensland, where it has caused severe defoliation in young plantations. Treatment consists only in protecting the bunches with sacking.

Panama disease. This serious disease is caused by the fungus *Fusarium cubense*. Symptoms are the development of a deep yellow colour round the margins of the lower leaves, which later turn brown and die out. The leaf stalk collapses and the dead leaves are left hanging round the pseudo-stem. Diagnosis may be made with certainty by examination of the corm, which when split lengthways will be found to contain numerous brown to black lines running in all directions. They penetrate into the vertical partitions of the leaf stalk and are in this position a quick means of identifying the disease. Control can only be effected by a rigid policy of exclusion and eradication with all sanitary precautions.

Dry Rot. The disease is caused by certain of the mushroom and bracket fungi including a *Poria*. The corm tissue is replaced by a mass of fungal threads forming a dry, punky substance of a dirty white or brown colour. The leaves die back from the margin and the pseudo-stem can often be easily pushed over owing to the absence of sound roots. As a rule only individual plants are attacked. Infected stools should be removed and burnt.

Cigar End. This is a disease caused by the fungus *Stachyliidium Theobromae* which confines its attacks to relatively young fruit in the plantation. Decay starts at the apex and extends back for about $\frac{1}{2}$ inch. Spores are produced in abundance and form an ashy grey or pinkish coat over the decayed area. The shrivelled floral organs often persist on the ends of the affected fruit. Usually a few fruits only are affected. The young bunch should be exposed to light and air and the remaining bracts removed.

Black Finger. The causal agent is a fungus (*Phoma* sp.). Black decay starts at the fruit tip and extends backwards to the base until the whole fruit becomes involved. This eventually shrivels up and becomes mummified. The fruiting bodies of the fungus appear on the surface in the form of numerous minute pustules. The disease is not sufficiently frequent to call for control measures, but light and air should be admitted to the affected plants as for cigar end.

Gumming. Gummed fruit presents a pinched appearance at the apex and on being split open lengthways exhibits a reddish-brown, gummy condition of the tissues below the flower tip and along the centre. Dark gummy specks may also be found along the outer margin of the pulp. Occasional fruits in a bunch are affected and do not ripen, especially at the tip, as soon as the others. A bacterium is suspected as the causal organ. Control measures are not yet necessary in Queensland.

Black Pit. Skin lesions consisting of small reddish spots developing later into shallow, black depressions $\frac{1}{8}$ – $\frac{1}{4}$ inches in diameter are formed, particularly on the upper hands and on mature fruit. Disfigurement of the skin sometimes rendering the fruit unfit for sale is the chief cause of loss. The origin of the disease is unknown, but it may be checked by bagging as for leaf spot.

Squirter disease. The pulp of the fruit decomposes into a dark semi-fluid state, so that a pressure of the hand will expel it in a stream from the stalk end. A dark area of rotting tissue is found along the centre of the fruit in the early stages. External symptoms are often lacking. The casual

agent is the fungus *Nigrospora sphaerica* which gains entrance through the broken fruit stalk either in the plantation or during packing. It attacks the fruit only in the intermediate stages of maturity. The disease occurs in the cooler months only, and temperature and delayed ripening may have some bearing on its incidence. Control is mainly obtained through strict packing shed hygiene. Bagging as for leaf spot may reduce liability to attack by preventing chilling. *Fruit Stalk Rot or Black End*. A transport or market trouble caused by various wood parasites entering through the broken fruit stalk. Strict packing shed hygiene will effect control. *Anthracnose*. Rapidly enlarging dark sunken areas appear on the fruit skin of gathered fruits. Later a water soaked condition extends into the pulp. The causal fungus is *Gloeosporium Musarum*. No definite means of control are known. The disease occurs mainly in the summer.

298. TAM, R. K., AND MAGISTAD, O. C. 634.774-1.84 : 581.192
Relationship between nitrogen fertilization and chlorophyll content in pineapple plants.
Plant Physiol., 1935, 10 : 159-68, bibl. 11 ; also published as *Tech. Pap.* 77
 of the Pineapple Exp. Sta., Univ. of Hawaii.

An attempt is made in a series of field experiments carried out at the Pineapple Experiment Station, University of Hawaii, to show the relationship existing in leaves of pineapple plants between the total chlorophyll ($\alpha + \beta$) concentration and various amounts of nitrogen applied as fertilizer. With few exceptions an increase in the amount of nitrogen applied resulted in a corresponding increase in the total chlorophyll concentration amounting in one case to more than tenfold. The control plants in this plot were decidedly chlorotic and underdeveloped, while those receiving nitrogen, 38.4 lb. per 1,000 plants, were large, dark green and healthy. Least response was obtained when the chlorophyll levels in the control plots were already high. The maximum application of nitrogen did not produce the maximum total chlorophyll concentration. The number of applications of nitrogen had little effect on the chlorophyll content, but earlier applications showed slightly increased chlorophyll concentrations. It is, of course, necessary that the other requirements for chlorophyll formation, such as light, iron and magnesium should be present in sufficient quantities.

299. MAGISTAD, O. 634.774 : 547.979.8
Carotene and xanthophyll in pineapples.
Plant Physiol., 1935, 10 : 187-91, bibl. 10.

Pineapple fruits owe their yellow colour to carotene and xanthophyll, the former predominating. The quantity of carotene present ranges from about 0.10-0.25 mg. per 100 gm. flesh. There appears to be no marked loss of carotene or xanthophyll in canned pineapples. Carotene is a precursor of vitamin A, but pineapples as a source of this vitamin rank far behind lettuce, spinach and carrots.

300. LEWCOCK, H. K. 634.774-2.411
Pineapple wilt disease and its control.
Qd. agric. J., 1935, 43 : 9-17.

The main cause of wilt in pineapples in Queensland is ascribed to attacks on the roots by the pathogenic fungus, *Phytophthora Cinnamomi*. The foliage of plants which have been attacked assumes a drab olive colour in place of its normal dark green, turns limp and flabby, and finally collapses. The fruit stalk withers for a few inches below the fruit but remains rigid enough to hold the fruit upright. If the latter is still immature it colours prematurely, becomes spongy in texture, and subacid in taste. In this condition it has no commercial value. Losses from this disease can be largely prevented by suitable cultivation conditions. These are : land that is well drained, protected from erosion, well supplied with organic matter and suitably acid in reaction. In this last connexion the optimum soil reaction for growth, productiveness and longevity of pineapples lies between pH 4.5 and pH 5.0.

STORAGE.

301. HARDING, P. L. 664.85.11

Physiological behavior of Grimes Golden apples in storage.

Res. Bull. Ia. agric. Exp. Sta., 182, 1935, pp. 317-52, bibl. 50.

Part I. Respiration determinations were made on Grimes Golden apples throughout two storage seasons at temperatures of 60°, 50°, 36° and 30° F. The respiration intensity of the apples was increased or diminished with the rise or fall of the temperature, but did not exceed in either direction the respiration rate of fruit held constantly at the two temperatures. When fruit showing a high rate of respiration was transferred to a lower temperature resulting in retarded activity, a disturbance was caused within the tissue which was subsequently shown by soggy breakdown. Transfers from high to low temperatures made at a time when respiratory activity was low did not produce soggy breakdown. Immediate storage after picking prolonged the life of the apple. Respiratory activity in the Grimes apple stored at 50° F. had four stages of intensity. (1) A short period of accelerated ascent; (2) a short period of rapid descent; (3) a longer period of gradual descent; (4) a period of senescence in which a slight rise of respiration occurs due to complications such as mealy breakdown and scald. Apples from high nitrogen plots at 50° F. consistently respired more than apples from control plots, but at 36° or 30° F. temperature proved the controlling factor. Deferred storage fruit, i.e. fruit held at 50° F. for 3 weeks before being placed in lower temperatures, from high nitrogen plots developed a higher percentage of soggy breakdown than did the controls. Part II. In deferred storage fruit subsequently kept at 30° and 36° F. and in immediately stored fruit kept all the time at 50° F., catalase activity was greater at 30° F. than at the other two temperatures. Respiratory activity and catalase activity were not consistently correlated. Fruit from nitrate treated trees had a greater catalase activity than fruit from untreated trees. Increased catalase activity appears to indicate physiological disturbances within the tissues of stored apples. Oxidase activity was not found to be a significant indicator of the development of soggy breakdown.

302. PLAGGE, H. H., AND OTHERS. 664.85.11 : 632.1

Functional diseases of the apple in storage.

Bull. Ia. agric. Exp. Sta., 329, 1935, pp. 78, bibl. 17.

The paper describes the differences between the various functional diseases of apples with particular attention to those storage troubles which the authors have encountered in apple storage research work. *Apple scald* which causes the skin to become brown and easily broken can be controlled by oiled paper wrappings. Proper maturity, low temperature, prompt storage and ventilation are important in scald control. *Jonathan spot*, a skin disease in which circular blackish spots up to $\frac{3}{8}$ inch in diameter, often becoming confluent in storage, appear on the skin of the apple, is readily controlled by storing immediately after harvest at low temperature. *Mealy and soggy breakdown*. The former which is often due to old age may be postponed by proper handling and storage. The latter is caused by low temperature slightly above the freezing point of apples (29-34° F.), i.e., a temperature too low for the apple to complete its normal storage cycle. A temperature of 36° F. and prompt storage (within a week) after harvest will avoid this trouble. *Brown heart* occurs when apples are stored under conditions favouring the accumulation of carbon dioxide gas. *Watercore* develops in fruit before it is picked and is probably caused by high temperature in the fruit while still on the tree. Affected fruit will recover in storage but its storage life is considerably shortened. *Bitter pit* is characterized by sunken spots on the surface of the apple extending into the flesh as brownish corky areas. Prompt low temperature storage checks its development. *Freezing injury* is often confused with breakdown and other storage diseases. Apples slightly frosted in storage have a characteristic mealiness and a slightly fermented taste. Fruit frozen repeatedly or for a long time shows a browning of the vascular tissue. Apples severely frozen in store can often be rendered marketable by thawing out gradually below 40° F. Cork, drought spot, York spot and crinkle are dry corky lesions on the surface of the apple when on the tree (as distinct

from bitter pit which develops in storage). *Penicillium soft rot*. The importance of this fungus disease is the reason for its inclusion in this paper. The fungus enters through abrasions of the apple skin and quickly causes the fruit to decay. Careful handling and prompt storage at 32°-36° F. will hold the disease in check. Storage results for 10 years indicate that apples keep longer, have better flavour and colour and fetch a higher price when stored at 35°-36° F. than at 31°-32° F. Apples that have been carelessly handled or are not wrapped in oiled paper keep better at 31°-32° F.

303. OSTERWALDER, A., AND KESSLER, H. 664.85.11.037 : 632.4 + 632.19
Das Auftreten des Fäulnis und nicht parasitärer Krankheiten bei der Kühllagerung des Obstes. (The incidence of rots and of non-parasitic affections in cold stored fruit.)
Reprinted from *Schweiz. Obst- u. Weinb., Wädenswil*, 1934, pp. 413-528, bibl. 45.

In the trials made between October 1929 and June 1930 nine different apple varieties were stored at 4° C., 2½° C. and 0° C. in 20 kg. lots on each occasion and a few of each variety in an ordinary ventilated cellar. In a second trial from October 1930 to the end of May 1931 approximately 20 kg. lots of 13 different varieties were observed under temperature conditions of 4° C., 2° C., 0° C. and -1° C. Monthly examinations revealed the condition of the apples, any rotten or otherwise damaged specimens being then removed. *Parasitic rots*. Of fungi responsible for the rots the following species were found, namely: *Penicillium glaucum*, *Monilia—Sclerotinia fructigena*, *Botrytis cinerea*, *Mucor piriformis* and *M. stolonifer*, *Fusarium putrefaciens*, *Gloeosporium album*, *G. fructigenum*, *Phytophthora omnivora*, *Phaciidiella discolor*, *Nectria galligena*, *Alternaria* sp., *Cladosporium herbarum*, *Trichothecium roseum*. In the first trial about 38.2% by weight of all the cold stored apples went rotten, in the second about 20.3%. *Gloeosporium album*, being little affected by temperature, was responsible for very much the most damage. In 1929-30 935 or 67.9% of all the rotted apples were attacked by this fungus and in 1930-31 1,102 or 85.1%. *Fusarium* accounted for 12.4% and 5.3% respectively in the two years. *Cladosporium herbarum* was found to be only weakly parasitic on fruit stored too long. Strong varietal differences were noticeable in the resistance of the stored apples to rots in store. The incidence of rots decreased with decreased store temperature, the still considerable number of rot cases at the lower temperatures being very largely due to *G. album*. Rotting increased with length of storing especially from February onwards. An exception to this was provided by the Glockenapfel which even at the end of June only showed 20 rotten apples out of 60 kg. Inclination to rot appeared to depend appreciably on the nutritional condition of the tree and incidence of rotting varied considerably in the same variety according to place of growth. A precaution which should always be taken before storing is the removal of all fruits injured by wounds of any sort. Size grading is also advisable as the larger fruits are found to rot sooner than the smaller. *Non-parasitic breakdown*. The phenomena here may be grouped into 3 types: (a) "Rindenbraune" or scald, (b) "Frostflecken" or soft scald, and (c) non-parasitic browning of the flesh. Scald was found in these trials to be closely connected with the age of the fruit and to be favoured by the higher temperatures. Varieties differed in their susceptibility. Apples wrapped in paraffin and mineral oil paper were less attacked than unwrapped apples. It was found possible to produce the effect artificially on pears by treating with amyl acetate, acetaldehyde and formaldehyde fumes. The soft scald phenomena corresponding to those described by American workers would appear to have been caused in these Swiss experiments by exposure to low temperatures even for a very short period, hence the name "Frostflecken". The phenomenon of flesh browning is again differentiated into 3 types: (a) Due to over-ripeness, the fruit becoming pulpy, as is often the case in early varieties, (b) Browning of the fruit pulp, which is a phenomenon of age and must be differentiated from Kidd and West's "Brown heart". (c) Untimely browning of the fruit flesh. This may appear in apples after a summer like that of 1931 marked by much rain, little sunshine and early frost. Bitter pit may be counted as belonging to this type of breakdown. There is also a browning due apparently to cold storage alone. This was very little seen in the first year's trials, but in

the second year at 2° C., 0° C. and -1° C. more than a few cases occurred in particular varieties. Its incidence varies not only with variety but with place of growth and nutrition of tree. It is identical with the phenomenon known as "internal breakdown" in England and America. Apples so affected sometimes resemble over-ripe pears in composition and even in smell and taste. The presence or absence of acetaldehyde cannot account for this. Two types of browning due to cold storage may be distinguished: (1) flesh juicy, more or less firm; (a) flesh containing large amounts of acetaldehyde, taste like sleepy pears; (b) flesh containing little acetaldehyde without pear taste. (2) Flesh mealy, dry, does not contain much acetaldehyde. Apples having this browned flesh are both outwardly and within like those suffering from frost and the phenomenon gives many indications of being due to the effects of cold. The formation of acetaldehyde and the decrease in acids may be compared with a similar phenomenon which arises when apples are bruised without the skin being broken. The authors were unable to confirm the theory that such browning results from the accumulation of volatile oils or other volatile substances. Again differing in their results from American workers they were unable to note any controlling effect due to wrapping with oil papers. With reference to atmospheric humidity in the case of smooth skinned varieties such as Ontario the incidence of browning was not appreciably less with a humidity of 72% than with one of 83% in the cold store, but the rougher skinned Boskoop was appreciably less liable under drier conditions. The water content of fruit was evidently a factor influencing the onset of browning. Haynes' theory that there must be a direct connexion between high acidity and internal breakdown in cold store was not substantiated nor were the authors able to confirm her opinion that preliminary storage at a higher temperature is expedient. Unripe fruits were found less ready to brown than ripener ones. The tendency to browning increased with unfavourable and damp growth conditions of the tree. Large fruits were more prone to it than small, and small crop fruits than large crop fruits. Apples from trees of normal growth and pruning were found less susceptible than those from hard pruned trees. [From authors' summary.] Eight plates, four being coloured illustrate symptoms of the more frequent disturbances due to parasitic or physiological agents

304. SMITH, G. G., AND FELLERS, C. R. 634.11 : 577.16
Vitamin C content of twenty-one Massachusetts grown varieties of apples.
Proc. Amer. Soc. hort. Sci. for 1934, 1935, 31 : 89-95.

The work of previous investigators is discussed and their results are tabulated. The apples used in the authors' investigations were after harvesting stored at 33° to 34° F. until fed to guinea-pigs. Five of the varieties tested were triploid, and there was great difference in the vitamin content of these. Baldwin was the only triploid among the 4 varieties here found particularly rich in vitamin C, the others being Northern Spy, Ben Davis and Winesap. In the present investigations seasonal or other variations except storage* caused little change in the vitamin C content of any one variety. No apparent correlation was found between the vitamin C content and the chromosome number of an apple.

305. WORMALD, H., AND PAINTER, A. C. 664.85.22.037 : 632.42
Brown rot of plums in cold storage.
Annu. Rep. East Malling Res. Sta. for 1934, A18, 1935, pp. 148-50, bibl. 2.

An examination of diseased plums stored at 40° F. showed the presence of *Sclerotinia fructigena*, *S. laxa*, *Botrytis cinerea*, *Penicillium* sp. and *Mucor* sp., the first named predominating. To prevent such disease attention should be given to sanitation in the field and to picking. The plums should be picked with their stalks and no plum showing the slightest trace of rot should be taken. No plums should be taken from trees showing much brown rot. Wet fruit should not be stored. Condensation of moisture on the surface of fruit on removal from store should be avoided.

* Fellers found that Baldwins lost some 20% of their vitamin C content when stored at 36° F. for 4 to 6 months. (*J. agric. Res.*, 1933, 46 : 103-9.)

306. EZELL, B. D., AND DIEHL, H. C. 664.85.13
Relation of maturity and handling of Bartlett pears in the Pacific North-west to quality of the canned product.

Tech. Bull. U.S. Dep. Agric., 450, 1934, pp. 24, bibl. 16.

The work described extended over a period of more than 3 years. The material consisted of pears from 2 orchards in the Yakima Valley, Washington, one being on a heavy loam soil, the other on a light sandy loam. In the preparation of the different lots a composite sample was selected from the different trees. In determining maturity 10 representative pears were taken and pressure tests were made on the pared flesh after harvest by the U.S. pressure tester, using the $\frac{1}{16}$ in. plunger. Pears were picked at pressure tests ranging from 20 to 7 lb. over a period extending from the picking for the first commercial fresh shipments to that for the last commercial pickings for the cannery. Pears intended for the cannery gave the best finished product when harvested at a pressure test of 17 to 15 lb. The best canned product resulted from transferring to cold store at 30° to 32° F. immediately after picking, keeping there 15 to 20 days and then ripening. Ripening was most rapid and uniform when carried out at 70° to 75° F. A relative humidity of 78 to 85% in the ripening room gave satisfactory results. No appreciable effect on the canned product could be attributed to soil differences.

307. ROBSON, G. 664.85.3 : 632.4
Mould wastage in citrus fruits (Rhodesia).

Food Manuf., 1935, 10 : 159-61.

Most common citrus fruit decays are due to a rind injury through which the blue and green moulds (*Penicillium italicum* Wehmer and *P. digitatum* Sacc.) are able to gain entry by means of the oil vesicles, the other skin tissues being apparently immune to shallow infections. Citrus varieties are not all equally susceptible. Washington Navel is considered to be the most susceptible and Valentia Late the least. Green mould can be well controlled and blue mould less so by immersing the fruit in a warm 5% solution of borax or borax and boric acid. A 3% solution of sodium bicarbonate controls blue mould but is less effective against the green. A 2% solution of sodium silicate of 41° Baumé is stated to control both blue and green moulds. Pure food legislation and the expensive and cumbersome plant required are deterrents in the use of this class of fungicide. Gas treatment with carbon dioxide is not very successful with fruit except in concentrations which impair the flavour of the food. Ammonia is very toxic to blue and to green mould at low concentrations but is awkward to handle, and if used in slight excess of the concentration necessary to kill spores, it may produce skin blemishes and also affect the juice, as does acetaldehyde. Nitrogen trichloride gas sold under the trade name of Agene, which has been used for many years for maturing and improving the colour of flour, is lethal against a number of citrus decay fungi. About 75% of wastage may be saved over a period of 8-10 weeks by treating citrus with this gas in concentrations of 15 mgm. per c.f. given in 3-5 treatments of 3 hours each (5 hours for the first treatment) at 3 to 4 day intervals from the first day of storage. This gas has to be used immediately it is made.

308. WARDLAW, C. W., AND LEONARD, E. R. 664.85.653.037
The storage of avocado pears.

Mem. Low Temp. Res. Sta. Trinidad, 1, 1935, pp. 20, bibl. 3.

The aim of these investigations* is to prepare the way for an export trade with Canadian and British markets. West Indian varieties show a wide range of variation in colour, shape, size, skin texture, stone : pulp ratio, colour and fibre content of pulp and palatability. This genetic variability is reflected in keeping qualities and behaviour in cold store. It was again found that most of the varieties tested cannot stand being held for normal commercial periods, i.e. 16 to 25 days at 45° F. They become chilled with discoloured pulp and sometimes skin. If, moreover, the same varieties are kept at higher temperatures, they ripen too quickly. Out of 50 varieties tested only 6 are recommended for trial shipment as being of suitable shape,

* They continue those recorded by Wardlaw in *Trop. Agric.*, 1934, 11 : 27-35. (Authors' note.)

size, flavour and keeping quality at 45° F. They are Pollock, St. Joseph 1*, St. Joseph 2, St. Joseph 3, Lenegan and Maqueripe 2. It is recommended that these shall be picked fully grown but quite firm, or in colouring varieties full grown but green, suitably packed and protected in slatted crates and transported at a steady temperature of 45°. The shipping of other varieties is merely likely to prejudice West Indian produce as they are almost certain to arrive in bad condition on distant markets. It is found that, when chilling occurs at 45° F., maturation of the tissues continues but follows an abnormal biochemical trend, culminating in the production of a soft, darkened pulp of poor flavour. Certain varieties are found to lend themselves to gas storage, but here again great differences may be noted, e.g. in tolerance of high CO₂ or low O₂ concentrations. The effect was also tried of smearing fruit with vaseline, liquid paraffin and other substances. The application of these relatively impermeable substances definitely delayed ripening, but those tested so far are found to limit gaseous interchange to an extent inimical to normal ripening.

The following also is noted :—

BISSON, C. S., AND OTHER. **Determining changes in stored material by use of a reference element.** *Proc. Amer. Soc. hort. Sci. for 1934, 1935*, 31 : 122-4, bibl. 2.

PACKING, PROCESSING, FRUIT PRODUCTS.

309. MINISTRY OF AGRICULTURE, LONDON. 634.1/8-1.56

Fresh fruit : grading and marking.

Market. Leaflet. Minist. Agric. Lond. 59, 1935, pp. 80.

This leaflet deals with the National Mark Schemes as regards apples, black currants, cherries, cucumbers (glasshouse), gooseberries, hothouse grapes, loganberries, pears, plums, raspberries, red currants, rhubarb (forced and natural), strawberries and tomatoes, and gives full details of how intending users of the scheme should proceed to grade, mark and pack the fruit or vegetable concerned. The various grades are explained with illustrations. Seven appendixes contain other exact information on standard containers, labels and covers, conditions of registration of distributors, experimental schedule of canning grades, while the approximate periods during which the schemes are in operation are tabulated and notes are given which should help growers to gauge the size and colour of black and red currants. The bulletin is essential to all users of the scheme and should be of considerable interest to horticulturists in other parts of the Empire faced with marking and home marketing problems not entirely solved.

310. TEMPANY, H. A. 664.85.774

The trade in canned fruits in the United Kingdom.

Malay. agric. J., 1935, 23 : 164-71.

This article is concerned mainly with the export of Malayan canned pineapple to the U.K. Imports of canned fruit into U.K. consist almost entirely of pineapples, peaches, pears and apricots. The imports for 1930-33 show that pineapple was the principal fruit imported and most of this came from Malaya—711 thousand cwt. for 1933, with Hawaii the next highest sending only 25 thousand cwt. Malayan pineapple maintains its place on the market because of the very low cost at which it is sold, 4½d.-3½d. per 1-lb. tin. Australian pineapple retails at 11d. to 1s. 1d. for a 2-lb. tin and Japanese from 5d. per 1-lb. tin. Malayan canned pineapple has a more marked flavour due to the variety, and is more fibrous than that from other countries, both peculiarities being regarded unfavourably on the market. Canned fruit from Australia is making considerable progress in U.K., being cheap and of excellent quality. The need for improving the quality of the Malayan product to meet this competition is stressed, though it is

* Names given arbitrarily for convenience. (Authors' note.)

admitted that considerable progress has been made in this respect. During the current year imports into the U.K. have already considerably exceeded those for the corresponding period in 1933 while Canada also provides a potential market of great possibilities.

311. GILL, H. C. 664.85

The fruit canning industry of the Empire. An economic survey. I.

Food, 1935, 4 : 268-70.

In this, the first article, the survey is confined to the U.K. and is mainly concerned with the nature of the competition to be faced by British canners. The establishment of a definite standard for British canned fruit is advocated. Factories which produce below the standard should be legislated off the home market. The British canned fruits most in demand are berry fruits and plums. These do not come in direct competition with the bulk of imported canned fruit which consists mainly of pineapples, peaches, pears, and apricots and constitutes 80% of the total imports. The chief fruits directly affected by foreign competition are loganberries and cherries. The recent pronounced rise in imports of berry fruits from Empire sources and the steep decline in foreign imports is shown. The figures are—in 1931 from Empire sources 6,005 cwt., in 1934 26,716 cwt.; from foreign sources in 1931 65,494 cwt., in 1934 33,020 cwt. Canada is responsible for most of this increase, the chief fruit being the loganberry from British Columbia. The main foreign source of supply is the U.S.A. and imports from that country show the considerable decrease of 28,915 cwt. since 1931. The author laments the lack of detailed statistics for the British industry which, he says, makes an economic comparison very difficult. In 1924 the approximate quantity of berry fruit canned in U.K. was 45,000 cwt., in 1930 180,000 cwt., and in 1933 about 450,000 cwt., at which figure production will probably remain stationary for the next year or so. The price for home produced canned berry fruits has fluctuated little, being always in the neighbourhood of 9s. per dozen No. 2 size cans of National Mark produce. In the case of plums (in variety), competition from both Empire (7,857 cwt. in 1934) and foreign sources (845 cwt.) is unimportant and that from foreign sources is shrinking rapidly, the demand for home-grown fruit and the import duties being jointly responsible. The figures for the U.K. are estimated only and are assessed at 150,000 cwt. for 1933. Prices for canned plums show a steady decline, dropping from 8s. 6d. per dozen No. 2 size cans in 1932 to 6s. 2½d. per dozen in 1934. The public taste is for any other canned fruit in preference to plums, and it is suggested that both a qualitative and a quantitative control might be advisable for this fruit in order to maintain the price and raise the standard of public taste for the fruit.

312. H.B.C. 664.85.323

The canning of grapefruit.

Food Manuf., 1935, 10 : 113-4.

Grapefruit for canning is allowed to ripen on the trees, since under-ripe fruit or fruit which ripens after picking has a marked bitter flavour and the flesh is difficult to remove without breaking. The fruit is graded and then scalded in water at 206° F. to facilitate removal of the skins. It is yellow-peeled by hand, having been first cooled by water sprays on the peeling table for easier handling. The peeling is completed on the lye peeler, where it is sprayed above and below by a 1.5 to 2% solution of caustic soda slightly below boiling point for 10-15 seconds. The lye solution and particles of loose membrane are removed under strong sprays of water and the fruit passes to the segmenting operators *via* the drying fans. To remove the sections rapidly and unbroken is difficult work requiring considerable practice. In some factories lye peeling is not used at all, the entire work of peeling being done by hand. The cans are hand filled, the segments being packed close together to form a solid pack, 17 oz. of fruit being packed into a No. 2 can. Sugar is added in syrup form at a density of 60° Brix, to the equivalent of 2 oz. of sugar. Cans are usually sealed in a vacuum closing machine and sterilized at 180°-190° F. for 40 minutes. The cans after sterilizing are immediately cooled in water. Plain cans are used instead of lacquered, hydrogen swells being found to develop more slowly in the former. The vitamin content of canned grapefruit is much the same as that of raw grapefruit.

313. PICKFORD, P. T. H. 663.3
Experiments on the improvement of the juice from culinary and dessert apples by maceration with pressed bittersweet pomace. Progress reports I. and II.
Annu. Rep. Long Ashton Res. Sta. for 1933, 1934, pp. 141-3, and *J. Bath. W.S. Co. Ass.*, 1934-5, 9: 165-8.

In the 1932 experiments the once pressed pomace from bittersweet apples was resoaked with juice got from an equivalent weight of market varieties. The juice was then allowed to macerate for 12 hours and in one case for 24 hours. This was repeated in 1933, and in addition one batch of juice was pressed immediately with the pressed bittersweet pomace, Bramley's Seedling and Dabinett being the two varieties concerned. In both years the bittersweet character of the juices was considerably enhanced. Cider made from this treated Bramley's Seedling juice was found to be greatly superior in flavour, cleanness of taste and palatability generally and to have a pleasant softened acidity absent in the cider from the untreated Bramley juice. No advantage was gained by prolonging the maceration period beyond 12 to 14 hours. Moreover, the method of immediately re-pressing the pomace gave approximately the same degree of improvement as prolonged maceration treatment: it was also found to be quicker and simpler and to entail less labour in the cider house.

314. SABOUROFF, N. V., AND KALEBIN, M. I. 663.3
The effect of sulphurous acid on apple pulp pectin.
Fruit Prod. J., 1935, 14: 275-7, 280, 283, bibl. 8.

Sulphurous acid is used very largely in the preservation of fruits in the confectionery industry, but its effect on the several fruit components has not been studied very completely. In this paper its effects in various concentrations (from 0.05 to 0.30%) on apple pectin are studied. From data obtained in the experiments it is concluded that the sulphurous acid amounts used in practice do not exert any specific influence on apple pectin.

315. GOUVERNEMENT GÉNÉRAL DE L'AFRIQUE OCCIDENTALE FRANCAISE. 668.52
L'essence d'orange en Guinée Française. (Essential oil of orange in French Guinea.)
Agron. colon., 1935, 24: 124-7.

It is claimed that the essential oil of orange extracted by the natives of Guinea is not a substitute for the orange oils of Sicily as are those of California, Spain and the West Indies, but an identical product capable of replacing it at a very much lower price. The native method of preparing the oil is described. It consists of sitting under a tree and gently scraping the skin of the orange with a tin spoon. It is a popular form of labour. Oil obtained in this manner is, of course, full of impurities and these have to be eliminated without delay or the character of the essence will be altered. The chief risks are run in storage and transport since air, light, heat and contact with iron even if galvanized, all quickly render the product unsaleable. The native is, however, aware of these risks and counteracts them as far as possible by the use of bottles. In trying to establish an export trade it is necessary that only a product of first-rate physical quality should be sent out. A chemical analysis under present conditions is out of the question. Oil for export should be compared with a type specimen which should be changed regularly, as owing to the action of the light causing resinification the colour will not remain constant. Oil for export should have the typical scent free from other smells. A standard package should be devised and the various assortment of receptacles now used should be discarded. In 3 years the world consumption of orange oil has increased by 140 tons, the total consumption in 1930 being about 60 tons, all produced in Sicily. This could be increased still further if prices fell—though it is essential that they should not fall low enough to prove unremunerative. As it is the low cost at which Guinea essential oil can be produced has entirely killed the Sicilian trade, reducing the amount exported from that country to under a ton. At present, therefore, the market for essential oil of orange is in the hands of the people of French Guinea!

316. POORE, H. D. 588.427

Passion fruit products.

Fruit Prod. J., 1935, 14 : 264-8, 285, bibl. 6.

Analyses are reported of the juice, seeds and shell of the passion fruit. A machine is described for separating the juice from the pulp. The results of preserving the juice by freezing, pasteurizing and concentrating are given and also methods for making carbonated drinks, jellies and syrups. The composition of an edible oil pressed from the seeds is given. [Author's summary.]

317. SAVAGE, C. G., AND ARTHUR, J. M. 634.771/3-1.56

Banana "figs" and banana "coffee".

Agric. Gaz. N.S.W., 1935, 46 : 199-200.

A short account of investigations carried out at the Hawkesbury Agricultural College, Richmond. "Coffee". Semi-ripe bananas proved the easiest to handle. The process is as follows:—the skin is removed, after which the fruit is quartered lengthways and cut with stainless steel knives into pieces about 2 inches long. It is then put on wooden trays into the dehydrator. It is kept there at a temperature of 120° F. for the first 9 hours and at 130° F. for a further 9 hours. Roasting takes place in an ordinary coffee roaster, the exact temperatures and time required for this varying with the condition of the fruit and the colour required. When bone dry it is ground. Loss of weight from raw banana to "coffee" is about 80%. The product can then be used alone or blended with coffee. "Figs". The fruit should be just approaching the ripe stage but should still be firm. The skin is removed (if necessary immersion in boiling water for a few seconds will facilitate this). It is then cut into halves lengthways and put on wooden trays. Next it is submitted to sulphur fumes at a concentration of 1 to 1.6%, which is equal to burning 1½ to 2½ oz. sulphur for every 100 cu. ft. of air space in the cupboard or room concerned. Exposure for 15 minutes is generally enough. The fruit is dried in the sun or preferably in dehydrators, where it should dry satisfactorily at 120° to 125° F. in about 18 hours. It is then removed to boxes and allowed to sweat for 1 to 2 weeks before being packed into ½ lb. or 1 lb. packets. Loss of weight in the finished 'fig' is about 75 to 80%. Crystallized, it is said to form a delicious sweetmeat.

318. GEORGI, C. D. V., AND BUCKLEY, T. A. 634.6-1.56

Fuel economy in the palm oil factory.

Malay. agric. J., 1935, 23 : 67-75.

It is important that the palm oil factory should be made as self-supporting as possible, and in the matter of fuel a large amount of combustible waste material is available which, though not an efficient fuel, ought to be able to supply all that is necessary without the aid of wood. The main sources of waste product fuel are the nut shells and the pericarp residue, of which the shells are the more important, being greater in quantity, more easily handled and slower of combustion. The moisture content of the fuel should be reduced as far as possible by air drying. Fuel with a high moisture content is uneconomical because it is heavier to handle and because of the loss of heat required to vaporize the water it contains. The attendant should be careful to see that the fuel layer is not so thick that it causes smoke and incomplete combustion, or so thin that it burns fiercely and heat is lost in the excessive draught. In the boiler waste of steam should be avoided by adequate heat insulation and the utilization of exhaust steam to heat the boiler feedwater. Tables are given showing the calorific value of the fuels usually employed in palm oil factories.

319. TEIK, G. L. 634.58-1.56

Notes on the frothing of groundnut oil.

Malay. agric. J., 1935, 23 : 78-9.

A frothing tendency, more marked with local than with imported groundnut oils, has been noticed when the oils are heated. This frothing appears to be due to the presence of very small amounts of kernel tissue which are not removed by the ordinary filtration process after expression of the heated meal. The oil obtained by cold expression does not froth on heating but the full quantity of oil cannot be obtained by this method alone. The difficulty can be surmounted by

treating the crude oil with caustic soda. The refined oil after washing with water to remove soluble soap and excess alkali, followed by filtration, will not froth when heated. The free fatty acids present in the oil will also be removed by this treatment. A more economical treatment, which, however, entails the use of storage tanks, is to allow the filtered oil to settle for a fortnight to three weeks, before drawing it off without disturbing the sediment. An alternative method which would need less tank accommodation would be to filter and market a cold pressed oil which would approximate to 70% of the available oil and be of "first quality", and to recover the remainder of the available oil by reducing the residue to a fine state of division and hot pressing the meal. This oil would require to be settled as described and would be of "second quality".

320.

COOKE, F. C.

634.61 : 634.984.72

Charcoal manufacture from coconut shell.*Malay. agric. J.*, 1935, 28 : 172-4.

Charcoal can be obtained from coconut shell heated in a closed space without the presence of air. Large quantities of volatile by-products are produced at the same time, but these require an efficient retort and condensing plant for their recovery. To obtain charcoal only the age-old method of burning in turf or mud-sealed heaps is used in Malaya. The enclosed heap is fired through a central hole previously filled by a stake and when the shells are thoroughly burning the supply of air is cut off, carbonization proceeding without further combustion. Good charcoal is produced by this method which takes about 12 hours. In the morning the pile is watered and allowed to cool off. In Ceylon, where excavation is possible without reaching water, the charcoal is made in covered pits 4-6 ft. deep. The fire is started at the bottom with a few shells and then built up till it is full and well alight, when it is watered and closed down. Alternatively a hollow bamboo pipe is placed vertically in the centre and the pit filled to ground level with shells, paraffin poured down the pipe and lighted, the flames watered and the pit closed. The specification for charcoal in London is as follows. Not more than 15% volatiles, not more than 10% moisture. The requirements for size are that not more than 10% should remain in a mesh with 1 inch holes or more than 5% pass through a mesh with $\frac{1}{4}$ inch holes. Good quality charcoal should be uniformly dark and free from inherent dirt due to husk. When dropped on a stone floor the pieces should emit a clear bell-like ring, and the broken edges show a sharp conchoidal fracture. The manufacture of good charcoal requires great skill and experience since even slight misjudgment will spoil the charcoal, either through incomplete combustion or overburning. In practice the yield of shell charcoal is 25% or less of the weight of the coconut shell. In Malaya the cost of production for export including selling charge, insurance, etc., is about £6 per ton including freight. Prices offered by European buyers in 1931 were between £10 and £11 per ton, but a recent quotation was as low as £7 per ton delivered.

321.

ANON.

635.23

A mandioca e sua utilidade. (Some uses of cassava.)

Bol. Agric. Zootech. Vet. Minas Geraes, 1935, 8 : 39.

This note is concerned with one further addition to the many uses of cassava, it having been recently discovered that the residue from the roots used in making motor alcohol forms an excellent cake of high nutritive value for cattle. A kilogram of this cake can be obtained from the amount of cassava necessary to produce a litre of alcohol. Since the government of the State of Minas Geraes, Brazil, has lately established motor alcohol factories with a view to reducing the consumption of petrol, this discovery is likely to be of great economic importance.

The following also are noted :—

GREGORY, J. A. 634.1/8-1.56. **Packing house management.** *Qd. agric. J.*, 1935, 43 : 71-3.

GREGORY, J. A. **Apple packing for export and home markets.** *Qd. agric. J.*, 1935, 43 : 39-70.

DE CASTELLA, F., AND KRONE, B. P. **Grape packing for local trade and export.** *J. Dep. Agric. Vict.*, 1935, 33 : 96-100, 102.

NOTES ON BOOKS AND REPORTS.

322. BARKER, A. S.

631.8

The use of fertilizers.

Oxford University Press, London, 1935, pp. 204, 7s. 6d.

This book is not intended as a contribution to the purely technical side of literature but is an attempt to consider the available technical knowledge of fertilizers in its economic and practical implications and, where data established by experiment are not available, in the light of the practice of farmers and growers. As the author remarks, there is practically no information established by scientific methods for many of the crops to which the farmer has had to turn in his search for fresh sources of income. The book opens with an account of how plants feed, the description of various soil types and the nature of plant foods supplied by fertilizers. Nitrogenous, phosphatic and potassic fertilizers are each given a separate chapter. Mixed and concentrated fertilizers are then discussed and methods of mixing by hand or machine are described. Subsequent chapters deal with the valuation, purchase, storage and the economics the use of fertilizers. The final chapter consists of a very general guide to the manuring of a large number of crops including fruit. The recommended dressings are given in pounds of nitrogen, phosphoric acid and potash per acre, while a table of fertilizers showing the number of pounds of these plant foods contained in 1 hundredweight of each of the commonly used fertilizers provides a means of rapid calculation of the quantities required to carry out any recommendations made. Agriculturists, who usually have little time to spare, will find that from the standpoint of rapid reference this book will provide sound advice with the minimum of thumb licking.

323. CHRONICA BOTANICA.

58(058)

Chronica Botanica, 1935, vol. 1, pp. 447. Editor, Fr. Verdoorn, P.O. Box 8, Leiden, Holland, 15 Dutch florins.

This is described as an independent annual devoted to all branches of plant science. It claims to be an exhaustive and up-to-date address book of institutions and societies. It is proposed to review in it each year the important current research in all branches of plant science. The present issue contains a full account of the programme which it is proposed to carry out at the Sixth International Botanical Congress to be held in September of this year at Amsterdam. Briefer notices follow on other conferences of a botanical or applied botanical nature also due for 1935, the XIth International Horticultural Congress to be held at Rome in September included. The largest section concerns work of a botanical nature in progress throughout the world, starting with Afghanistan, where notes are given of a German botanical expedition, to Zanzibar, where we find that at the Agricultural experiment station of Kizimbani work is in progress on green manures and preservation of soil fertility. A small section is devoted to correspondence. A list of new periodicals is given and new and changed addresses of botanists are noted. In a second issue a little more balance might perhaps be expected and the editorial note to the effect "we wish to emphasize that the length of an item is no criterion with which to judge the scientific importance of the matter contained therein" suggests, as indeed is the case, that some of the information given is lamentably long-winded and some all too meagre, but does not entirely excuse the fact. The information must naturally largely depend on the answers to questionnaires, and 137 of these, it is stated, arrived too late for inclusion in the present volume. It is to be hoped that the definitely useful information afforded in this first volume may lead to a willingness on the part of institutes—already overburdened with the filling of many returns—to be prompt in sending in concise, accurate answers to further questionnaires [which it is promised are to be simpler. Ed.] and so ensure the completeness of future volumes. It is very easy to pick holes in all such work, to suggest, for instance, that in a *Chronica Botanica* some mention might be made of the Flora of Trinidad in course of compilation for the last few years at Trinidad, that a little extra polish would have inserted Trinidad in the table of contents on page 4 [an account is given on page 265-6], and that to anyone wanting to find Mr. X. Y. Smith in the index few things could be more infuriating than to be forced to wade

through most of the 51 uninitialled Smiths in the index in order to find him. If attention can be paid to such details in future editions, the editors will richly deserve the gratitude of practical botanists throughout the world and the 15 guilders, which is the price of the book. While full of facts and names it is redeemed from the deadly monotony not unjustly associated with similar year books by illustrations of persons, apparatus, plants, etc., liberally scattered through its pages. The reviewer is grateful for this as well as for the children's corner (not so named) on pages 380 to 383, where he learned more in a shorter time of botany in the Netherlands than he had ever been likely to do by years of tedious study. Having taken the precaution of borrowing a copy first, he is now ordering one for the library and he recommends other horticultural institutes to do likewise.

324. MINISTRY OF AGRICULTURE, LONDON.

634.1/2

Tree fruits.

Bull. Minist. Agric. Lond. 2, 1935, pp. 98, 1s. 6d.

The design of the bulletin, as stated in the foreword, is to place at the service of growers, in a clear and concise form, the extent of our present knowledge as regards tree fruits. The tree fruits discussed are apple, pear, plum and cherry. General hints on planting are followed by a section dealing with rootstocks and their choice. The sections dealing with rootstocks and with methods of propagation deserve to be revised and brought into line with recent published research. At present they might euphemistically be described as conservative in outlook. General notes are made on pruning and particular notes on the pruning of particular varieties, while the amateur will be grateful for the hints on the pruning of espalier peaches and apricots. Short sections are devoted to varieties of pears and apples and their storage, gas, cold and natural stores being discussed. Plum, damson and cherry varieties are next dealt with, notes and tables being given on the inter-fertility and times of flowering of cherry varieties in this country, while cherry pests and disease are very briefly touched on. The general considerations that should influence anyone wishing to start a cider or perry orchard are next reviewed and descriptions are given of the best known varieties suitable for the purpose. Points which will probably need attention in neglected orchards and the measures to be adopted are briefly discussed. The outline which is given of insect and pest control in the orchard will afford the grower some interesting and stimulating reading and help him in the purchase of his sprays. Certainly it should induce him to get the Ministry's more detailed publications on these subjects.

325. WORMALD, H.

632.42 : 634.1/2

The brown rot diseases of fruit trees.

Bull. Minist. Agric. Lond. 88, 1935, pp. 50, bibl. 5 pages, 1s. 6d.

This bulletin should prove of the greatest use to any research worker interested in any single manifestation of fungal activity due to any one of the so-called brown rot fungi of temperate regions which attack fruit. References to brown rot fungi are found as early as 1796. Late in the 19th century diseases caused by them became serious and since 1900 a considerable amount of study has been devoted to them in this country and abroad. Nomenclature has been the subject of serious controversy. The author considers that Harrison's* conclusions give the best interpretation of the situation which can be derived from our present knowledge. Harrison gives reasons for retaining the name *Sclerotinia fructigena* for the common fruit rotting fungus of Europe with buff-coloured *monilia* fructifications: *S. laxa* for that with a grey *monilia* stage in Europe: and *S. fructicola* for the common brown rot fungus of N. America. Wormald discusses the geographical distribution of the different forms throughout the world and describes their morphology. Notes are given on growing the fungi in culture media. Among conditions conducive to infection in the field are dull weather with frequent showers or mist, wet weather following a drought with resulting rupture of fruit skins, and mechanical injuries of the fruit from various causes. Curtis of New Zealand and others have examined the normal mode of entry of the fungus into different fruits and different parts of fruit trees in the absence of wounds,

* *J. roy. Soc. N.S.W.*, 1933, 67 : 132-77.

and their observations are noted here. The incidence of brown rot varies greatly and in some years is almost negligible, but even then enough infection occurs to allow the organisms to survive, and it is therefore essential that control measures should not be neglected even in the absence of much visible infection. Its attacks are described on apple, pear, plum, cherry, peach, nectarine, apricot, quince and medlar, and control measures are suggested. As general control measures applicable under all circumstances the removal of all sources of infection directly they are noticed is perhaps the most important. Again, since primary infection of the fruit usually occurs through definite injuries, especially those caused by insects, the control of pests indirectly helps to control brown rot. Suggestions are also made as to the possible help in control given by fungicides at different stages in the yearly development of the tree concerned. The necessity for selecting and packing sound fruit only and for keeping packing cases free from infection is also stressed.

326. MAURER, E. 634/635
Report on the garden section of the Berlin Dahlem Research Station. [German
 —Translated title.]

Landw. Jb., 1934, Band 79 (Ergänzungsband), pp. 9.

The efforts of the garden section are devoted very largely to the selection and improvement of commercial flowering plants. Special attention is at present directed to geraniums, hydrangeas, chrysanthemums, begonias, cyclamens, primulas and violas and short notes are given of the work in progress. Experiments are also being carried out on humus and on carbon dioxide manuring, on rhododendron soils, and on transplanting conifers. Investigations at the Berlin Agricultural College, also noted here, concern carnation selection, rose rootstocks and fruit tree rootstocks. The characteristics of several hundred apple, plum, cherry and pear varieties and some 40 quince and 73 *Prunus Mahaleb* plants are under observation in the nursery with a view to the eventual selection of rootstocks suitable for all emergencies.

THE LIBERTY HYDE BAILEY HORTORIUM.

Information has been received from Cornell University that the famous herbarium of Dr. L. H. Bailey has been presented by its owner to the University. The gift comprises 125,000 mounted herbarium sheets and other similar material and is specially rich in the cultivated floras of the world, containing many specimens not duplicated elsewhere; 4,000 technical or professional books germane thereto; thousands of photographs; card indices and equipment; buildings in which the collection is housed and a garden area on which to grow plants of record. The University has authorized the establishment of an administrative unit to be known as the Liberty Hyde Bailey Hortorium to maintain the collection. It proposes also to set up one or more graduate fellowships, which it is hoped will attract young botanists of distinction.

